PW PRACTICAL Winery & Vineyard JOURNAL

WINTER 2013

HALTER RANCH

Oak staves –
Measuring dose rates for inserts

Controlling oxygen at bottling to optimize post-bottling wine development

Potassium bitartrate/Calcium tartrate –
Cold stability of wine

Microbial biofilms –
source of winery contamination

Determining optimal ripeness for different white wine styles

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Cover Photo:
Halter Ranch Vineyard,
Paso Robles, CA

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Merger of two magazines

Dear Subscriber,

An important transition is underway for *Practical Winery & Vineyard Journal*. The editorial content of ***PWV*** will begin appearing in a new format, as the quarterly ***PWV Journal*** merges with *Wines & Vines* after this Winter-2013 ***Journal***.

The merger will bring the best parts of ***PWV*** to the pages, website, and digital editions of *Wines & Vines*. I will continue to source and edit ***PWV*** editorial content, and submit the articles to peer-review (when possible), according to the strict standards that have earned your respect for 33 years.

As a subscriber you will still receive the same quantity and quality of information and advice on grape-growing and winemaking topics that you have come to expect. In addition, *Wines & Vines* readers will benefit from the insights of the respected researchers and industry columnists in viticulture and enology that I have worked with for many years.

The merger increases the audience for ***PWV*** editorial content, because of *Wines & Vines'* larger circulation in print and digital formats. Plus, ***PWV*** readers, for the first time, will find ***PWV*** article archives published in full, online. To start with, the ***Journals*** (2011 and 2012) will be searchable on winesandvines.com in April when the first edition of the merged magazines launches. This is a capability you have requested for some time.

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WINES & VINES

Wines & Vines has the longest track record of any wine industry magazine — published since 1919 — but it is very up-to-date on content delivery. The publishing industry's evolution from pure print to a blend of digital and print requires that all publications have the level of strong technology capabilities which *Wines & Vines* now offers. It has a wider swath of wine industry readers and reaches them with more diverse and convenient formats, including digital editions for the web and mobile devices, email newsletters, a very active website, and social media.

All ***PWV*** subscribers, instead of receiving their magazine quarterly, will begin receiving monthly editions of *Wines & Vines* that incorporate ***PWV*** editorial content. This starts with the April edition and will continue until their previously established renewal dates. Those ***PWV*** subscribers who are also *Wines & Vines* subscribers will have their ***W&V*** subscriptions extended by the length of their remaining ***PWV*** term.

It has been a privilege to serve you at *Practical Winery & Vineyard Journal*. I look forward to the transition, because I believe it builds on the existing strengths of each publication. Thanks for your attention and support.

Don Neel

Don Neel
Publisher/Editor

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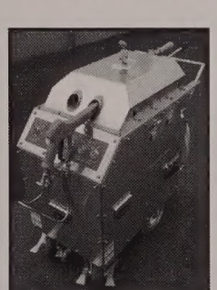

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WINERY DESIGN

HALTER RANCH VINEYARD

ORIGINAL DESIGN ELEMENTS OFFER MAXIMUM FLEXIBILITY

BY Bill Sheffer

Receiving hopper and vibrating conveyor can deliver 8 to 10 tons/hour of grape clusters to the Kappa 25 destemmer (right). Grapes are sorted at 2 to 3 tons per hour, and fed to the pod for transport to fermentor (left).

Halter Ranch Vineyard's state-of-the-art winery was designed and built to take advantage of the newest technologies, with efficiency, cleanliness, and maximum flexibility as goals. The 34,000 square foot structure is nestled into one of the original Macgillivray Ranch plantings in the Adelaida Hills west of Paso Robles, CA.

Halter Ranch Vineyard owner Hansjoerg Wyss first came to Paso Robles in 1995, to develop a vineyard on the west side. Wyss became familiar with the 720-acre Macgillivray Ranch that is directly adjacent to Tablas Creek Vineyard, and has the same soils and exposures that brought the Perrin family from Chateauneuf-du-Pape to Paso Robles in the early 1990s.

In 2000, Wyss purchased the Macgillivray Ranch to grow world-class Rhône and Bordeaux varieties. Although there were 40 acres already planted on the ranch when he arrived, Wyss and vineyard manager Mitch Wyss (no relation) began development of what now totals 281 acres of vines.

19 varieties are planted on the ranch: six Rhône red, five Rhône white, five Bordeaux red, Sauvignon Blanc, Petite Sirah, and Tempranillo. With all these different grape varieties, the winery had to be designed for many winemaking techniques and styles. Mostly planted on hillsides, 81 individual vineyard blocks have perfect exposures: south-southwest for red varieties and north-facing slopes for whites.

In April of 2011, Kevin Sass joined Halter Ranch as winemaker. Kevin worked at Justin Vineyard & Winery for 11 years, as winemaker since 2006. Kevin's tenure at Justin is particularly relevant because from 2000 to 2011, Halter Ranch was Justin's largest supplier of purchased fruit. Kevin's familiarity with Halter Ranch's vineyards and fruit has given him a unique ability to hit the ground running. The first 2011 wines that Kevin crafted there have been blended and bottled.

First harvest in the new winery was 2011. Currently the Halter Ranch brand is 8,000 cases (85% red and 15% white wine). The vineyard is capable of producing upwards of 40,000 cases, and the idea is to slowly grow to that production level.

The main facility was designed to be expanded over time, with the majority of the fermentation space built in the initial building construction phase. This includes the permanent tank fermentation area, four above-ground barrel/case goods storage rooms (each 4,500 square feet) for temperature control of white wine fermentation and malolactic fermentation, and new empty barrel storage.

Sorted grapes are dropped from pod into top of tank fermentor.

Mobile Pulsair Tank Mixer on mezzanine level. Winemaker positions the wand through the cap to the tank bottom, injects pulses of filtered compressed air under the cap, and moves the wand to different places under the cap until the must is well-mixed.

In addition, the building houses an indoor barrel working/portable fermentor room, the laboratory, and administration and storage rooms. The expandable portions would be barrel and case goods storage, which include caves and above-ground warehousing, and more space for larger fermentation tanks if needed.

The potential build-out of the facility was limited to a 50,000 case footprint with the idea that the best operational size would be about 38,000 cases (sized for the vineyard output). The footprint will accommodate the larger volume and the initial infrastructure (water, waste water, electrical, plumbing, and mechanical systems) installed initially or built with future expansion in mind.

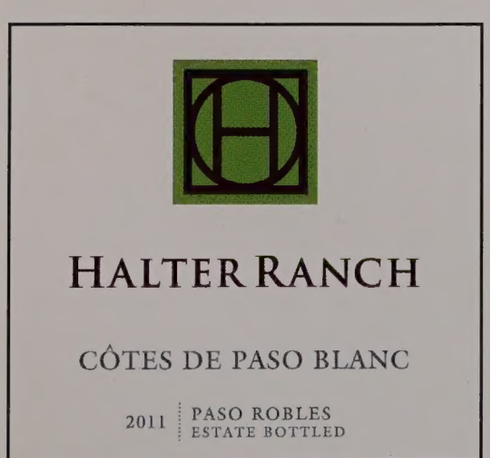
Energy efficiency above standard

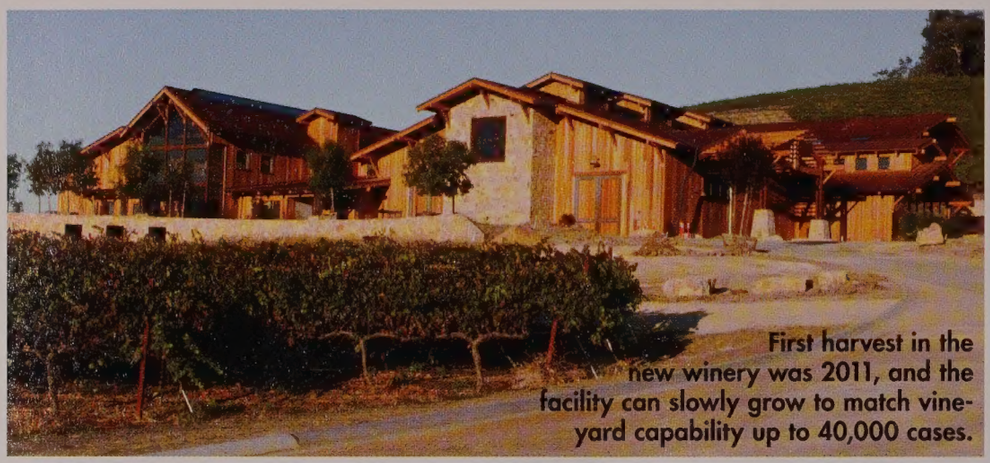
Elements of energy efficiency include concrete catwalks, concrete tank pads, night-air cooling, a CO_2 exhaust system, and skylights. Numerous stone walls are dry-stacked limestone mined from the ranch. A layer of limestone tops most of vineyard blocks at Halter Ranch. When soil is prepped for planting, this layer is broken up and some rock is, by necessity, removed prior to planting.

The 20,000 square feet of permitted caves (2,250 barrel capacity stacked three-high), have been excavated behind the winery and are accessible directly from the barrel-working room [see photo page 16].

The roof is an attractive post and beam construction where the beam expanse is strung with 5x8 clear Douglas fir tongue and groove (T+G) decking. On top of the T+G is oriented strand board plywood (OSB) followed by 2x10s set on edge. This is where many of the utilities are hidden, and the space is filled with bat insulation and covered with a layer of plywood. The roof is finished off with a vapor barrier and sheeted with corrugated Cortin roofing material to give the building a rustic look. This roofing system has a combined insulation value of R-42.

Main processing walls are constructed of an 8-inch concrete masonry unit (CMU block) wainscot to six feet above the floor. Atop the CMU wall area are 4-inch thick poly-





First harvest in the new winery was 2011, and the facility can slowly grow to match vineyard capability up to 40,000 cases.

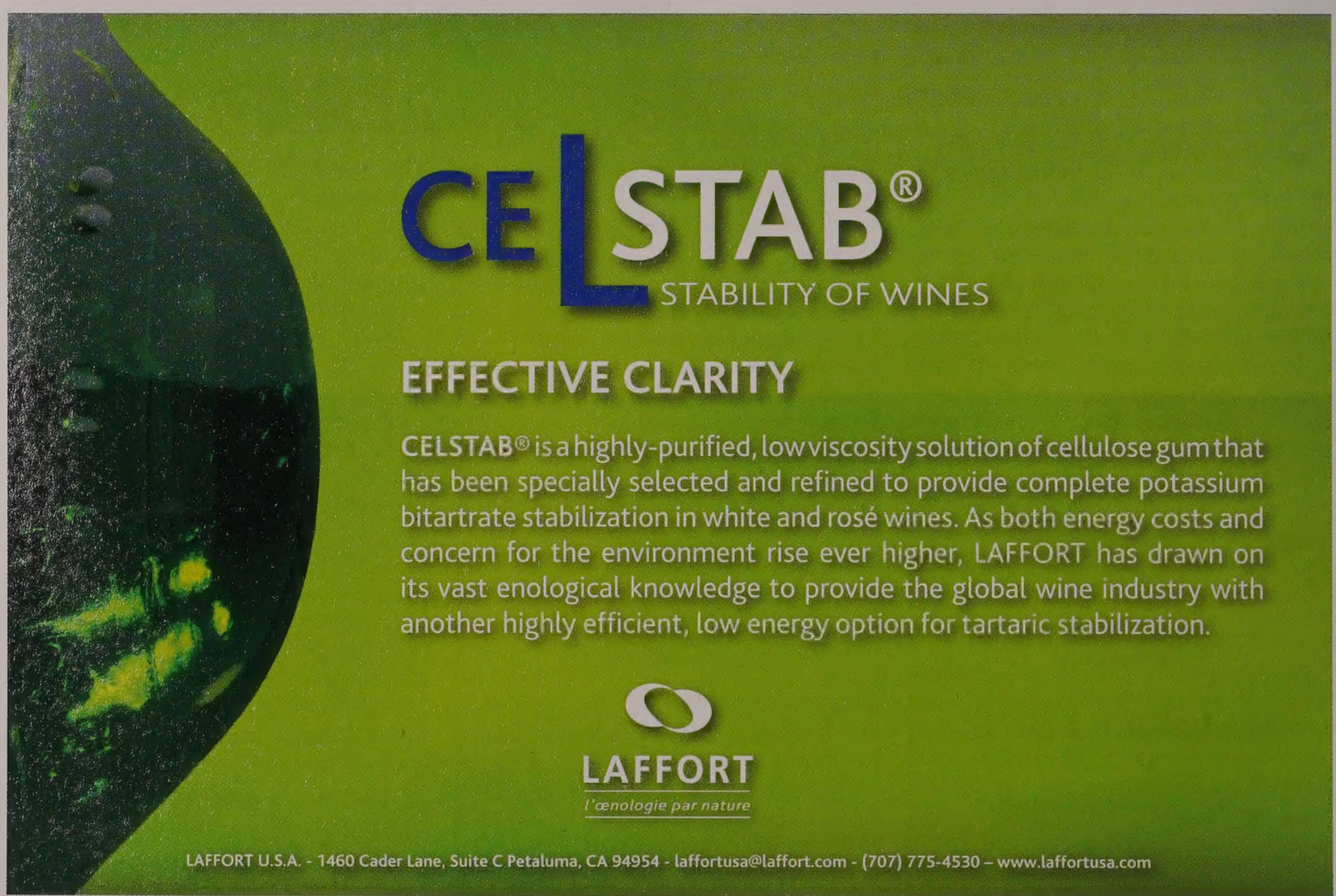
urethane panels on the interior and 2x6 studs on the exterior. The stud framing goes from the finished floor to the roof and contains R-19 insulation. The interior of the 4-inch panels is clad with corrugated galvanized sheeting and the block is coated with filler and epoxy, giving the interior corrosion and impact resistance.

Additionally, the exterior is covered with 1x12 cedar siding for architectural appeal. The perimeter wall system for the processing areas has a combined insulation value of R-53.

Warehouse walls are constructed of 12-inch CMU walls and coated on the interior with epoxy for impact resistance and humidity retention. The exterior of the CMU has 2x furring strips (creating an air space), covered with 1x12 cedar siding for architectural appeal. The warehouse perimeter wall system has a combined insulation value of R-50.

Added energy efficiencies are gained by the design. A choice was made to divide the warehousing space into four individual rooms separated by a forklift turning aisle and rolling/hanging insulated doors [see photo page 14]. At any given time, only one-quarter of the warehouse is exposed to the differential temperature of the cellar floor. The rooms can be climate-controlled independently, giving winemaking flexibility without subjecting the entire warehouse to seasonal needs for higher or lower temperatures.

An indoor barrel working area was another energy saving decision that many wineries either cannot afford or do not have the space to accommodate. Energy advantages are related to the high diurnal temperature in the Paso Robles area. Summer can have morning lows of 50°F rising to 105°F by 4 PM, making open roll-up doors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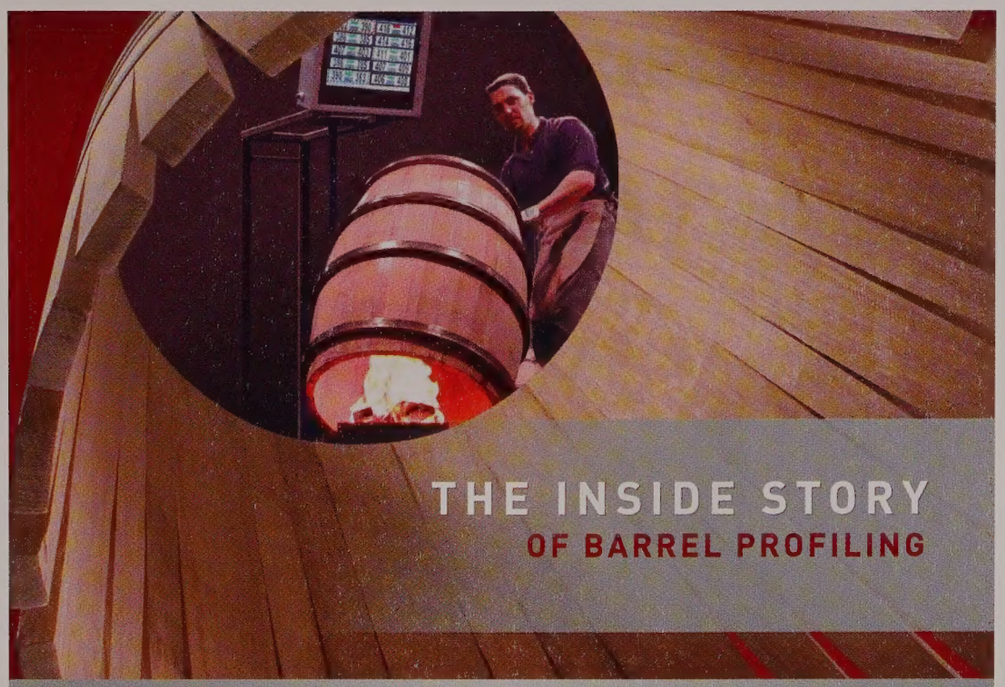
Dumping white whole clusters through the hopper into Diemme Velvet membrane press.

to 58°F barrel rooms or the cave very inefficient. Also, the indoor environment added to employee comfort for both high and low extremes.

The indoor barrel working area was designed for easy barrel placement, mess containment, and minimal forklift movement. The idea was to layout barrels and do all activities (empty, wash, refill) in place, minimizing the

Halter Ranch has two Diemme "Vintage 12" basket presses for small red grape lots requiring careful pressing.



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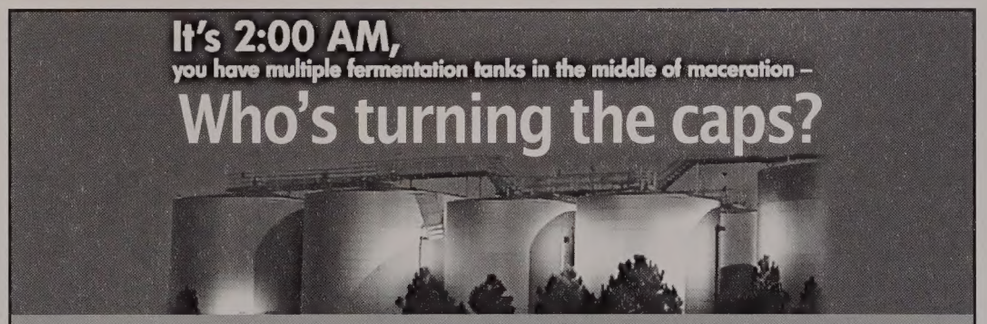

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number of forklift trips. Four strip drains are in the floor so that the barrel racks can be placed over a floor drain to contain the mess that occurs when cleaning barrels. The mess stays under the barrels and is not tracked around by the cellar crew while they work. A quick rinse-down before barrels are moved ensures the forklift route and barrel rooms stay clean.

All utilities for barrel working equipment were placed on the opposite wall from the forklift entry to allow movement down any aisle without disturbing any other aisle. This gives a continuous flow of barrel working activity without stoppage to move hoses, electrical cords, and equipment.

Hot (180°F) water is provided at the utility wall to support an AquaTools barrel-cleaning system and the fill hose for the ARS steam generating unit. A portable McClain Ozone Bugbuster unit is also along the utility wall, where it gets cold water and power.

To optimize heating energy efficiency, ensure a safer work environment, and provide hotter water only where and when needed for barrel cleaning, 180°F H_2O is produced by pulling from the 140°F standard plant system and then boosted to 180°F with a second boiler system. This boost system only runs when activated to wash barrels, and is only plumbed to the barrel washing utility wall.

Another component in the barrel working area is the positioning of two nitrogen hose reels that drop from the ceiling to provide nitrogen for a Racketeer debarreling wand. This helps keep the floor free of hose congestion and allows the forklift unencumbered movement.

CO_2 removal and night air cooling systems

The CO_2 removal and night air cooling systems were designed as a dual function system. Natural cooling of the building is achieved with louvers in the cupolas (located in the ceiling) coordinating with the exhaust fans. The diurnal swing decreases temperatures (at night), down to the low 50s. As the outside temperature falls below inside temperature, the louvers open and the exhaust fans turn on, drawing outside air to cool the building.

During the fermentation season, CO_2 monitoring equipment automatically activates fans in particular zones throughout the winery, to remove dangerous levels of CO_2 to the exterior of the building. In the barrel and case goods rooms, this is accomplished by wall-mounted fans set low to the floor that suck the gas to the exterior, while dampers in the ceiling open to allow fresh air in to replace the evacuating gas.

In an effort to minimize exhaust fan use and accompanying noise, maximize energy efficiency and usable floor space, and protect the architectural esthetics of the main facility, the decision was made not to use floor-mounted, boxy/ugly fans in view of the public. Corbett Wulfing (Project Manager), designed the CO_2 removal system for the fixed and portable fermenta-

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tion tank area to remove CO_2 by means of gravity. Although the same principle applies in the barrel working area and main fermentation room for CO_2 removal, those exhaust fans were installed 120 feet from the winery in a decorative retaining wall [see photo page 23].

Four CO_2 sensors are located on tanks at all four corners of the tank grid in the main fermentation area. There is one CO_2 sensor in the barrel working area, which during harvest is used as a fermentation room with small fermentation tanks.

There are two exhaust areas in the main fermentation room underneath two tanks. CO_2 sinks/enters the below-ground cavity and an exhaust fan outside the building vents the CO_2 through a 24-inch-diameter duct into the vineyard in front of the winery. A third exhaust fan draws CO_2 from the barrel working area and vents to a similar outlet. A CO_2 sensor and exhaust fan in each of the four barrel cells is controlled individually.

Tanks on concrete pedestals, with access to hot water, cold water, nitrogen, and compressed air. The tanks are "skirted" – welded to cover the gap between the bottom of the tank and concrete, so no water can get underneath the tank when cleaning or spraying down the outside.

Gravity flow for fruit processing

The facility is positioned against a hill and set in the vineyard for both beauty and function. A winemaking requirement was to process fruit using gravity as much as possible and to avoid pumping the must. The back of the winery where the grapes are received and weighed is 20 feet above the cellar floor. This upper level is accessed by a utility road that circles the building, allowing the efficient ingress and egress of fruit from the vineyard.

After weighing, the fruit can either be put into a cold storage room or processed immediately. The cold room can hold up to 50 half-ton bins and be chilled to 32°F.

The benefits of a cold storage room are many. If the day is hot, fruit can be stored in a colder environment. Because there is no opportunity to chill must in a gravity system, the room can be used to chill fruit more quickly than in a tank. Also, if

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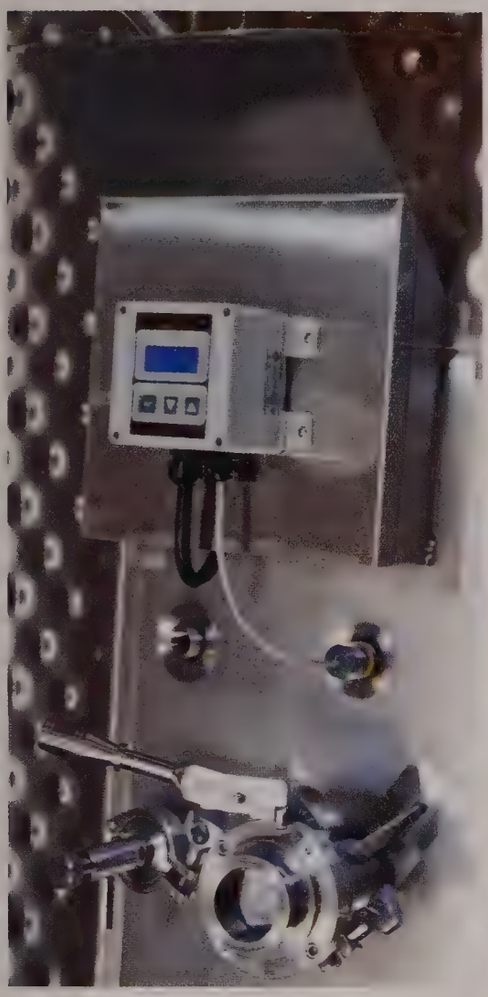
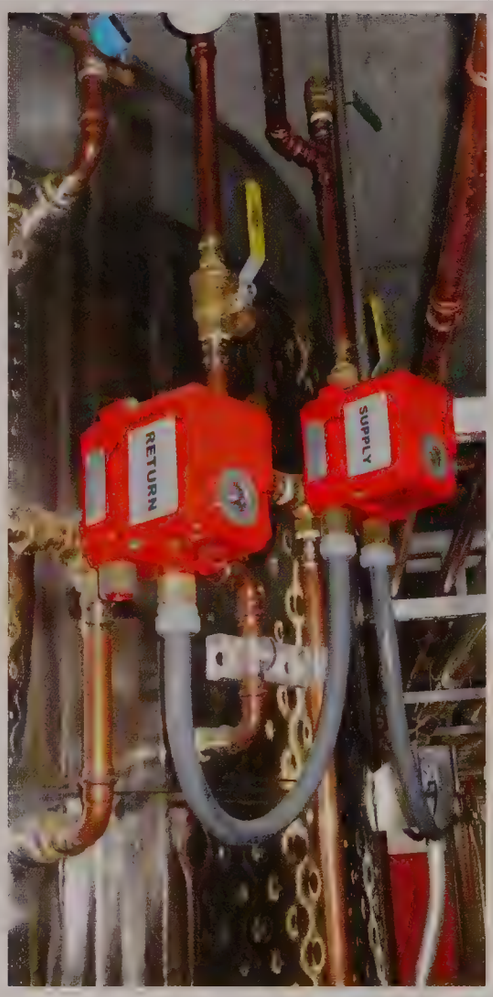
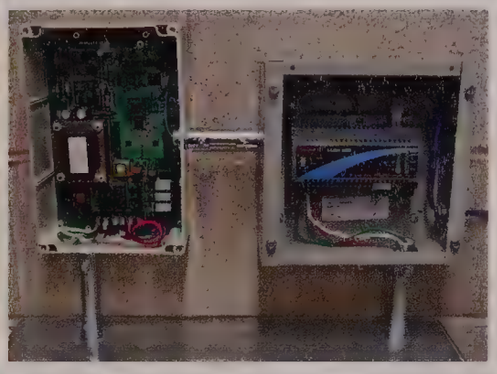




Halter Ranch TankNET® system

Left: TankNET® thermostat on fermenter provides automatic heating and cooling, brix entry and networking over 115VAC power to TankNET® browser/smart phone accessible control software. In addition, seamless integration between TankNET® and VinX2 production software gives a comprehensive view of winemaking process. **Middle:** Flomax 2-way and 3-way motorized ball valves provide reliable hot/cold flow, simplified plumbing and visual position indication. **Right:** TankNET® router at breaker panel provides communications link between 115VAC tank power and winery network.



there is more fruit picked on one day than can be easily handled, or if mechanical problems arise with processing equipment, some or all of the grapes can be handled on the next day, balancing out production flow.

Multiple levels

Three levels were established to move fruit though the system of cluster-sort, destem/grape-sort, and fruit transport to the fermentation tanks. At the upper level where fruit is received, a forklift dumps half-ton bins into a Burgstahler receiving hopper and onto a sorting conveyor [see photo page 6]. Clusters are inspected on this vibrating sorting conveyor, where they are then transported and dropped into the Kappa 25 destemmer on the second level.

The front end of the fruit processing system, which includes a receiving hopper and delivery chute, can deliver 8 to 10 tons/hour of grape clusters to the destemmer. For effective sorting, the cluster-sort table will need to run no more than 6 to 8 tons/hour with a current operating speed of 2 to 3 tons/hour. The Kappa 25 destemmer is capable of processing 20+ tons per hour. The slow link is the grape sorting table, which effectively sorts at 2 to 3 tons per hour, with a maximum throughput of 4 to 5

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Easy removal of barrels from storage cell (left) to indoor barrel working area (left, background). Two reels drop nitrogen hoses from the ceiling (right) to provide nitrogen for a Racketeer debarreling wand, keeping the floor free of hose congestion for unencumbered activity.

tons per hour.

After the fruit passes through the destemmer, the berries are removed and fall onto a vibrating/post-sorting table (see photo, page 6). Berries spread out over the vibrating table, where MOG is removed, and proceed to the transport pod sitting on the third level in the gravity system. Stems go out the end of the destemmer and fall through a hole in the second level deck into a dump truck positioned on the ground floor for removal.

Two pods for fruit transfer

The third level (called the mezzanine) is the same height as the opening on the top of the tanks in the fermentation area. The mezzanine floor is six feet below the exiting end of the post-sorting table on the second level. This allows ample space for a holding vessel (pod) to be positioned to receive sorted grapes. The pod is a custom-made 450-gallon open top stainless steel bin on four wheels with a truncated bottom to a 12-inch pneumatic knife gate valve [see photo page 7].

A 5-gallon pressure tank on the pod allows as many as three opening and closings of the knife gate without recharging. During normal operations, the pod is positioned under the sorting table and is plugged into the compressed air system each time while it sits during filling.

Two pods can each hold 1.5 tons of sorted grapes. While one pod is being filled, the full pod is transported to a tank from the sorting table. It is powered by an electric pallet jack, but could be

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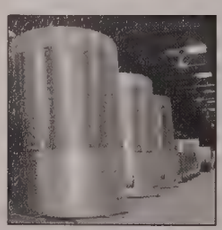

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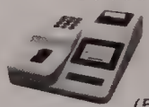

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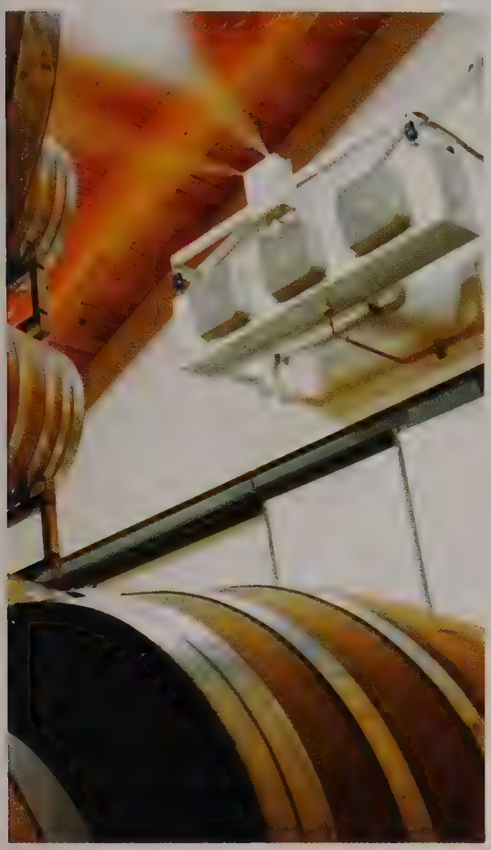

Smart Fog ES100-2 Non-Wetting Humidifier (part of the ES100 Humidification System), assures 75% humidity when wine barrels are in any of four storage rooms. When case goods are stored in a storage room, the humidifier is adjusted to 50% humidity.

uncoupled and moved by hand (with less fruit) if needed.

It takes less than 30 seconds to empty the 1.5 tons of must into the tank, with a round trip from sorting table to tank and back again in under four minutes. The pod system is capable of handling 15 tons per hour, but the maximum intent is to crush eight tons per hour, leaving ample time for the operator to transport the must.

Because the winery's current processing needs do not require speeds greater than 2 – 3 tons/hour and because of the rapidly changing technology in grape sorting systems, the Burgstahler grape sorting table was chosen and purchase of a faster grape sorting system was deferred for when production needs demand it and the technology has evolved further.

Concrete mezzanine to hold pods

The mezzanine itself is a catwalk constructed of concrete. It is open to the cellar floor with an aluminum hand railing and toe kicks, but the base is made of formed concrete with area drains instead of the usual expanded aluminum decking.

The concrete construction was built to support the weight of heavy equipment (1.5 tons of fruit in a pod being pulled around by an electric pallet jack) and to freely transport those things needed at the top of the tanks. Forklift gates are placed at the different levels and strategic locations to aid in the placement of equipment, pallets or half-ton bin as needed throughout operations.

The reason for the 60° angle of the hand railing [see photo page 10] is two-fold. The first is to facilitate the

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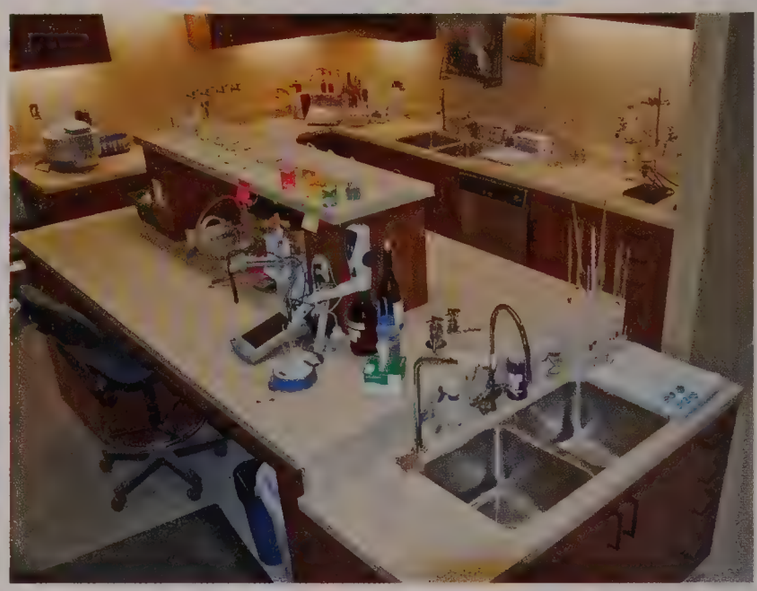

[RIGHT] The laboratory is 420 square feet with cream-colored Caesar Stone countertops.

[LEFT] The cave is 15 feet wide with an eleven-feet ceiling and has two potential entertainment areas (19 feet wide with 14-feet ceiling). Floor has a 2% slope for drainage. A sprayed-on impervious layer sandwiched between seven- and nine-inch thick shotcrete layers acts as a water seepage system for the walls and ceiling. The cave was constructed through wet-squeezing clay by Nordby Wine Caves (Santa Rosa, CA). Monitoring systems were employed during excavation to monitor movement due to expansive soils. There are two external and one internal (shown) access portals.

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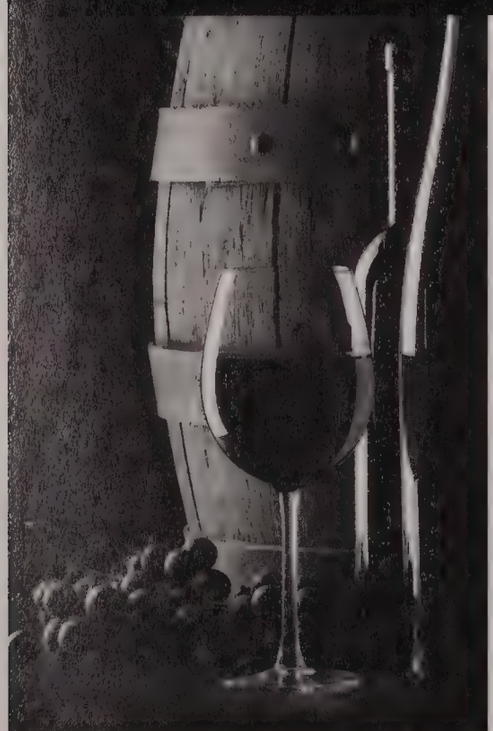

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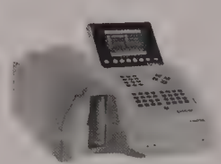

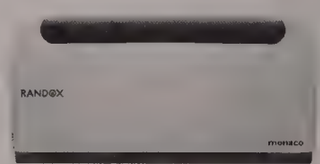

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mobile pneumatic ram that pivots in the manway tank opening for punch down [see photo page 10].

Because the mezzanine only covers half the tank top and the hand rails would cut across the center of the manway, it was necessary to provide space for the pneumatic piston at every position in the rotation. The second reason was to give room for the must pod to access the proper position to dump fruit into the tank.

Equipment/layout to satisfy multiple winemaking styles

Consideration of multiple winemaking techniques was a high priority with 19 different varieties, each requiring different winemaking methods to maximize varietal qualities.

White Fruit Processing — There are many options when it comes to white fruit processing. A Diemme Velvet 80 (80 hectoliter bladder press, maximum capacity six tons whole cluster) is on the ground floor [see photo page 9], 20 feet below the grape receiving area. The press is elevated four feet off the cellar floor to accommodate 1/2-ton bins to aid pomace removal.

There is a permanent receiving hopper attached above the press frame to receive large lots of fermented red grapes from the cellar floor.

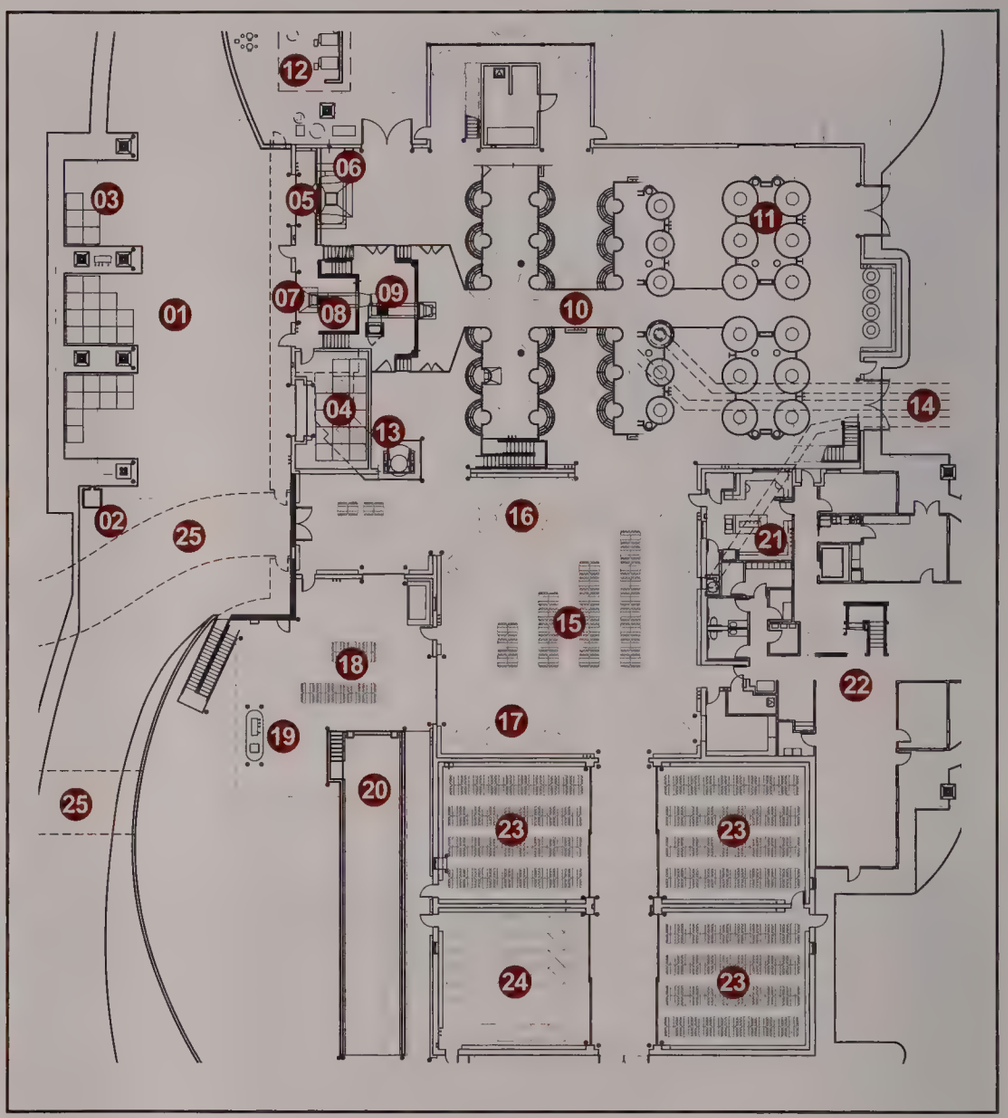
A second movable hopper is mounted on a rail above the permanent hopper to receive white whole clusters dumped from the upper deck.

White grape options are many: dump whole clusters directly into the bladder press from the grape receiving area; sort by dumping whole clusters onto a pre-sorting table set over the upper hopper; destem/sort into bins, then load into the press from cellar floor; and final destem/sort/dump into tanks for a cold soak, then drain, shovel into bins, and forklift into the permanent hopper above the press.

Red Fruit Processing — Multiple methods of cap management were either installed initially, or the infrastructure will allow easy installation if required in the future.

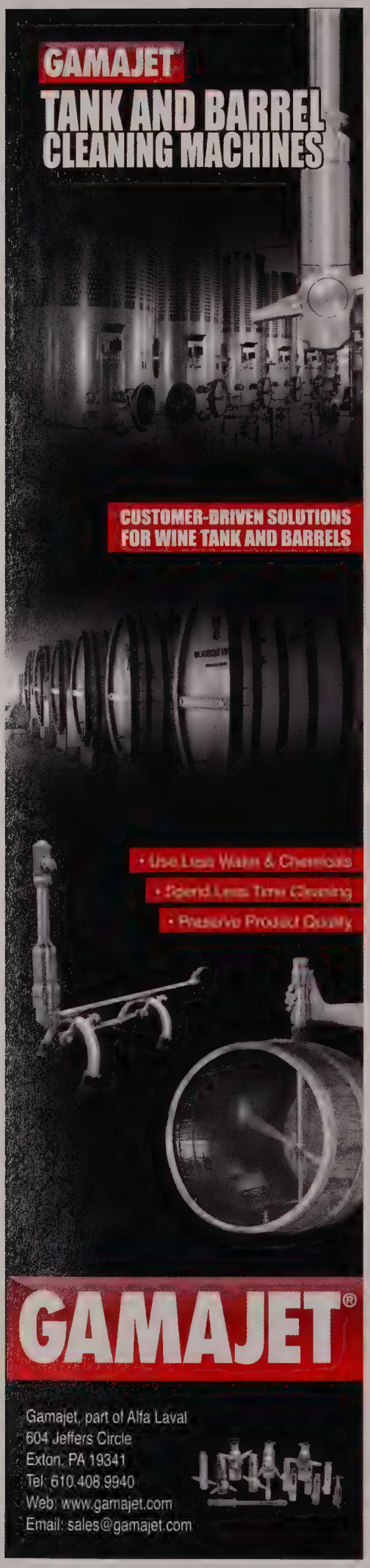
Pump-over, punch-down, portable Pulsair — The standard pump-over (PO) technique is a mobile/manual procedure before a more permanent system is installed. Typical pump-over can be performed by pumping from the tank-bottom racking valve using a positive displacement pump going through a hose passed to the top of the tank, where it is connected to a Toad irrigator. If pump-over becomes the dominant cap management method, then permanent lines, pumps, seed screens, and automatic IT controls can be installed.

A punch-down (PD) system was designed for the permanent 10-ton and 5-ton upright fermentation tanks. Chris Randell was employed to engineer a pneumatic PD device that would be portable and attach to bars welded into the upper manway turret [see photo page 10].



Halter Ranch site plan by Corbett Wolfing, Design+Build Collaborative, Paso Robles, CA

01 Fruit Reception
02 Scale
03 Macro-bin Staging Area
04 Macro-bin Cold Storage
05 White Fruit Processing Deck/Hopper
06 Bladder Press
07 Red Fruit Processing Deck/Hopper/ Dump Trailer Beneath
08 Cluster Sorting Table
09 Destemmer Deck/Berry Sorting Table
10 Tank Deck
11 Tank Cluster Pad
12 Mechanical Yard
13 Basket Press Pad
14 Gravity CO_2 Removal Drain/ Night Cooling Duct
15 Indoor Barrel Washing Area
16 Mobile Tank Area
17 Bottling Tanks
18 Outdoor Barrel Washing Area
19 Mobile Bottling Line Utility Island
20 Truck Dock
21 Lab
22 Administration Area – VIP Lounge Above
23 Barrel Storage Cells
24 Case Goods Storage Cell
25 Barrel Storage Tunnels



OnSite N-50 Pressure Swing Adsorption (PSA) Nitrogen Gas Generator system is plumbed to all water utility stations throughout the winery. This provides nitrogen to push wine in transfer pipes, sparge tanks, do inert transfers, and enable barrel pressurization for debarreling and bottling support. The unit can support a debarreling rate of 225 liters per minute at 12 psi or a bottling speed to sparge 50 bottles per minute at 25 psi. Debarreling utilizes a purity of 99.5% N_2 while bottling requires 99.95% N_2 purity.

Mounted three quarters of the way down the 6-foot-long pneumatic cylinder is a gimbal which has pneumatic pancake cylinders that lock the unit into position for PD. This keeps the unit from rising while the PD foot presses on the cap. The gimbal allows the cylinder to pivot 360° so that the PD foot can reach all areas of the cap.

Once the PD unit is locked into place, the operator holds onto the cylinder handles and presses pneumatic valves, raising and lowering the PD foot while pivoting the cylinder in the desired direction. After PD of a red fermentor is complete, the unit is unlocked from the mounting bars in the tank manway and moved to another tank, where the process is repeated.

A mobile Pulsair system can be moved among tanks on the mezzanine [see photo page 7]. The operator positions the Pulsair unit close to the tank manway and connects a 5/8-inch air hose feed to the Pulsair cart containing a 60-gallon air tank with Pulsair filters and delivery system. From the cart, a 1-inch hose attached to a 1-inch-diameter stainless steel wand is inserted through the cap from the top manway.

After the operator positions the wand through the cap to the tank bottom, the Pulsair is started to inject pulses of filtered compressed air under the cap, producing an impressive eruption. Move the wand into different places under the cap and the must is well-mixed. After the tank is mixed, the unit is moved to another tank and the process repeated.

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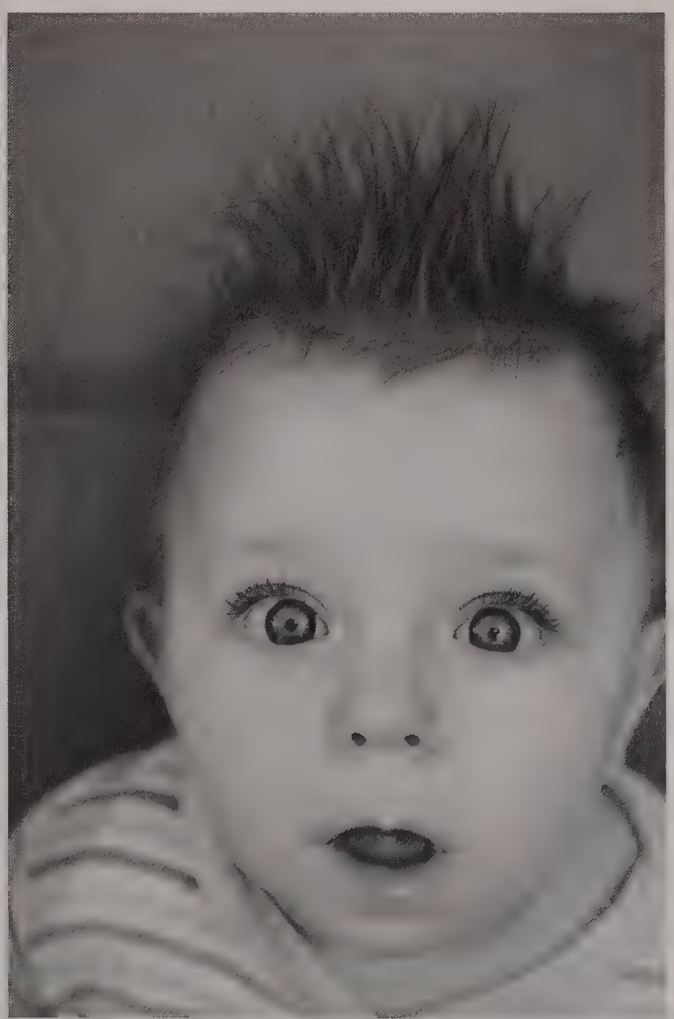

The roof is post-and-beam construction with tongue-and-groove decking, and combined insulation value of R-42. Skylights for natural lighting are set between cupolas that assist night cooling.

Drain reds over screen, shovel to bins — When the red fermentation/skin contact is complete, the tank is drained of free run over a screen set in a sump, the bottom manway door is opened, and the pomace is shoveled into half-ton bins. The pomace is then transported by forklift to either the larger bladder press to be combined with other tanks for large lot press fractions, or it is dumped in the smaller basket press cage for small lot separation.

Pressing options

There are great advantages to having options to choose from when it comes to pressing of fermented grapes.

Large lots to bladder press — The Diemme Velvet 80 bladder can press upwards of 20 tons/load of drained red pomace, giving the winery the advantage of combining like lots together for a more efficient production flow.

Small, high-quality lots to basket presses — Two Diemme Vintage 12 basket presses receive small lots and lots requiring more care in pressing. The press holds 2.5 to 3 tons of drained red pomace with no minimum volume requirements, allowing the pressing of very small amounts if needed.

Two presses holding 2.5 tons plus an additional basket were chosen over one 5-ton press with an extra basket for several reasons. First, Halter Ranch has many small vineyard blocks requiring small lot fermentation, and having two presses allows for more effective separation of wine lots. Second, efficiencies are gained with the smaller baskets — they drain faster and have a higher

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final yield in less time than a larger one.

Granted, there are more movements with smaller baskets, but the right flow and rotation along with the quick drain/press time offset the extra movements.

Also, larger baskets require a forklift capacity greater than 6,000 lbs that Halter Ranch does not have. The small 5,000-lb warehouse forklift is less expensive and easier to operate in the winery environment.

Other infrastructure innovations

Hot and cold glycol throughout facility — The winery was set up with both hot and cold glycol systems to handle fermentation needs, climate control in barrel and case goods storage areas, and administration heating and air conditioning. Each tank and individual environmental area has its own climate control to adjust temperature as needed. All individual controls interact to one of two main IT software systems.

The tanks are controlled by a TankNET system that includes an individual controller at each tank, networked to the winery's IT system. TankNET controllers can be monitored, adjusted, or used as a point of data input at the individual tanks, on any computer throughout the winery, or remotely via the Internet (page 13).

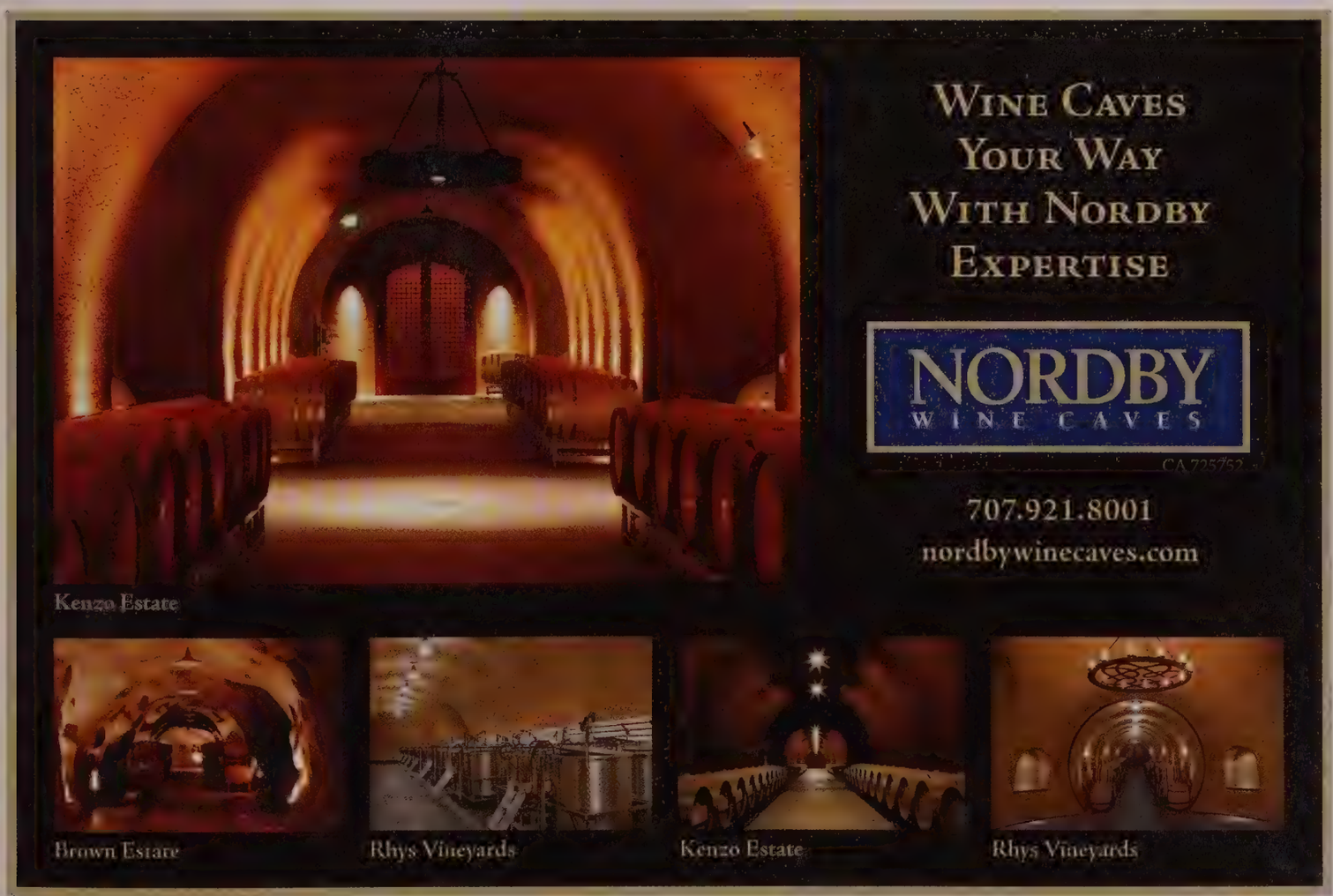
Heating on bottom tank jacket only, cooling on top jacket — Each tank can be heated or cooled with the simple push of a button. High and low setpoints are entered into the TankNET controller and adjusted as needed. When cooling is applied, the top and bottom jackets receive cold glycol, but when heating is needed only the bottom jacket is used.

Permanent upright fermentation tanks include 24 ten-ton tanks (12 in the first bay, 12 in a third bay), and 12 five-ton tanks (in the middle bay). Portable fermentation tanks in the barrel working area during harvest include 4 four-ton tanks, 4 three-ton tanks, 2 two-ton tanks, and 3 one-ton tanks.

Reduced water use and reuse (mess containment) — Cleanup ease and water conservation were important considerations in the winery design, to be sure that messes are contained and easily cleaned up while using minimal water. The waste water is treated and reused in the vineyard.

The concrete mezzanine has an uninterrupted aluminum toe kick that prevents water or messes from falling on top of the tanks or to the floor below. The mezzanine has a sloped concrete floor to area drains for fast, easy cleaning. The portion of the mezzanine that has fruit processing, and the two levels above, have ACO trench drains for fast cleanup.

Tanks on concrete pedestals — The tanks are placed on concrete pedestals instead of on tank stands. The pedestal gives added floor space while containing spills to the front



of the tanks. ACO trench drains were installed in all tank aisles instead of area drains, for ease and speed of cleaning [see photo page 12].

Floor slope and trench drains — All the floors throughout the winery have a minimum slope of 2% to ensure that the heavier particles can be easily moved to the drains with little effort and water. Sloped floors are more likely finished correctly by concrete contractors without areas that can puddle up (called "bird baths"). When the floors drain completely, they dry up quickly, leaving less chance for growth of mold and bacteria.

Water/waste water — The water for winery operations, office bathrooms, laboratory, and mechanical equipment is supplied from a well on the property. The water, although acceptable for vineyard irrigation, was deemed too high in dissolved solids to be suitable for long-term use on plumbing and mechanical equipment (boilers and glycol chillers) and unacceptable for addition to wine or winery cleaning. In addition, for equipment warranties to be honored, the water hardness needed to be 150 ppm dissolved solids or less.

To solve the water quality problem, a reverse osmosis (RO) unit was installed to produce 7,000 gallons/day, filling two 7,000-gallon tanks that are treated with ozone. This leaves a reserve of 14,000 gallons of treated water to satisfy an estimated daily use of 2,000 gallons/day at harvest time with a possible peak day use of 7,000 gallons.

The installation of an RO unit raised a dilemma between wanting to reduce water use and the amount of excess water needed to run an RO system. This dilemma was bridged by taking the waste side of the treatment system and diverting it to the waste water recovery/treatment system of the winery for reuse in the vineyard. In this way, the winery does use more water, but the net use between the winery and vineyard is unchanged.

Waste water solids removal/aerated ponds/water re-use — The processed waste water goes through a FlexRake screen to remove solids, and is then pH-adjusted before gravity flow to the two-stage aerated ponds. Waste water enters the first pond where it is automatically monitored for dissolved oxygen (DO) and aerated with brush aerators before moving to the second pond, where it is held before transfer to an irrigation pond.

Rain water recovery — The final effort of a water-responsible design is to install a rain water recovery system. The water from the winery roof is diverted to a sump, then pumped to the vineyard irrigation pond.

The collective area of the roof is about one acre and the average annual rainfall is 25 inches (2 acre feet/year, 651,702 gallons, or 1,800 gallons/day). The system will recover about the same amount of water that the winery is estimated to use at full production.

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CO_2 sinks/enters the below-ground cavity under tanks (left), and an exhaust fan outside the building vents the CO_2 coming out through ducts (right) into the vineyard in front of the winery.

Esthetic design: Form and function

Windows, glass roll-up doors, skylights — A lot of glass was incorporated into the architectural design for both form and function. As you drive up to the winery, you immediately see the stunning glass entryway that stands two stories high. The glass panels in the administration area are dual glazed, low emissivity (low E) glass, which reduces solar heat gain. The windows and skylights give lots of natural light, which increases employee productivity and mood, also reducing the need for artificial light and effectively lowering energy consumption.

Large walls of windows on the east side of the winery look into the tank fermentation area, and another large glass wall is at the main entrance. Inside the main entrance is a row of skylights at the top of the vaulted ceiling. The permanent fermentation room has skylights between the cupolas that let in night cooling air. The barrel working area has four skylights, and the forklift aisle separat-

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ing the four cells for barrels or case goods has two skylights. There are three large roll-up doors at the grape receiving entrance. ■

Bill Sheffer *has worked in the wine business for 30+ years, mostly holding winemaking positions after receiving a degree in production operation management from Cal Poly, San Luis Obispo, CA. He started as a cellar hand at the former Estrella River Winery (Paso Robles, CA), moving into an assistant winemaking position six years later for John Munch at Adelaida Cellars (Paso Robles). Sheffer has held assistant or head winemaking positions at 13 wineries, in four countries (36 vintages), and participated in numerous winery expansions and five new winery startups.*

In 2006, Hansjoerg Wyss hired Sheffer to make Halter Ranch wines, and achieve a winemaker's dream: the opportunity to take many ideas from his career and build them into the new Halter Ranch facility. With Sheffer, Wyss, and dedicated individuals on the Halter Ranch winery design and construction team, the project has become a reality.

Sheffer left Halter Ranch in order to repeat this dream, traveling with the vintages in both the Northern and Southern hemispheres, consulting on new winery construction and expansions.

Corbett Wulfing *was Project Manager and Construction Manager for JRM Development architect John Mitchell who designed the Halter Ranch Winery building. Wulfing contributed his expertise in winery planning, process flow, design, and construction of the Halter Ranch winery. Today, Wulfing is a Master Builder with Design+Build Collaborative, Paso Robles, CA.*

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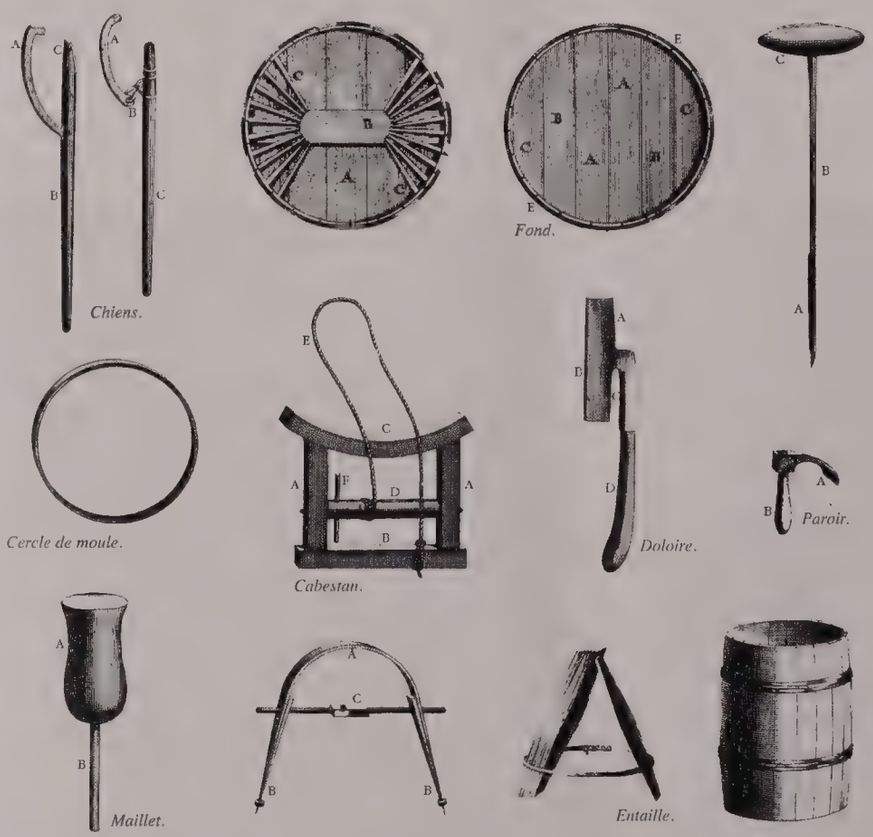

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Oak Insert Staves

Measuring dose rates for wood pieces

BY Andrei Prida, Benoît Verdier,
Tonnellerie Seguin Moreau, Z.I. Merpins, Cognac, France

French Oak medium plus toast Fan Innerstave (25.5 inches long, 2 inches wide, 5/16 inch thick), from a stainless steel red wine tank, Cline Cellars, Sonoma, CA.

Use of oak wood pieces is a practice by which it is possible to impart a given quantity of oak wood compounds to wines in order to obtain certain enological results, such as enhancing woody flavors, increasing complexity, mouthfeel, and structure. This practice has been legal in Europe since 2006 (Règlement CE 1507/06).

This operation enables winemakers to get the benefits of oak for low- and medium-range wines, which could not be aged in barrels because of the price barrier.

In practice, winemakers introduce wood pieces (chips, fragments, staves, sticks, etc) in stainless steel tanks at different stages of wine processing (in juice before alcoholic fermentation, during malolactic fermentation, or after malolactic fermentation during ageing) for a different duration of maceration reaching sometimes up to 12 months. Depending on the size of wood pieces, sometimes they are attached to the wall of stainless steel tanks, or they are just put into wine in bulk.

The impact of wood compounds obtained from barrel alternatives not only depends on the type of products (size, grain size, seasoning, etc.), origin of wood (French oak, American oak, etc.), toasting (light, medium, etc.), but also on the quantity of wood which is put into contact with the wine. The quantity of oak (dose) may vary a lot according to the type of result required. How to calculate the wood dose differs between the various alternative products.

The dose is generally expressed in g/L for small wood pieces (powders, chips). This approach is commonly accepted and provides consistent results, whereby winemakers find a correlation between the oak intensity and the quantity (in grams) of oak they have used.

In contrast, for big wood pieces (staves), there are two types of wood measuring. One is using the gram/L approach, while the other is the calculation of the area of wood in contact with wine as a percentage of the total volume of wine.

The second approach is linked to the analogy with barrel ageing (elevage). Winemakers frequently talk about the percentage of contact area of the new barrel (or of new wood) to express the dose of oak. Since the internal area of a 225L barrel is about $2m^3$, 100% of a new barrel is equal to 0.0089 m2/L. In cellar practice, winemakers seldom use a dose equivalent to 100% of a new barrel, but rather 30% to 50%.

What is the base of this calculation? The calculation, based on contact surface, reflects the hypothesis of proportionality of wood compounds migration according to the wine-wood contact area. The basis of this hypothesis is the very low penetration of wine into wood by its surface. In other words, independently of the wood thickness, the wine will always penetrate at the same (rather low) depth in wood and extracts the same quantity of wood extractives. The experience we have with barrels shows that this is certainly true as far as barrel aging is concerned.

There are two phases in the extraction of wood compounds during elevage in barrels. The first one corresponds to a progressive hydration of wood by wine (approximately four months), while the second one is a stationary phase during which the depth of penetration remains constant. The speed of liquid penetration into wood is a limitation factor for the extraction of wood compounds.[3] The depth of wine penetration into wood is about 2 to 4 mm; there are various estimates of such penetration according to the methodology used.

For example, F. Feuillat estimated this layer by measuring the humidity, which was considered as a marker of penetration.[2]

Figure 1. 18 mm stave used for wine ageing cut lengthwise to expose wood with no wine penetration.

The extraction of wood compounds occurs in this thin moistened area.

It is known that the face exposed to wine is the least penetrable (the direction is perpendicular to the radial cut). This leads to a slow extraction of wood compounds during barrel ageing. The quantity of whisky-lactones in the moistened layers was examined to be about 35% to 50% (in comparison to new oak) after two years of barrel using.[5]

This means that the migratory flow of wood compounds can quite accurately be described by the law of mass transfer and this flow is directly proportional to the wine-wood contact surface.

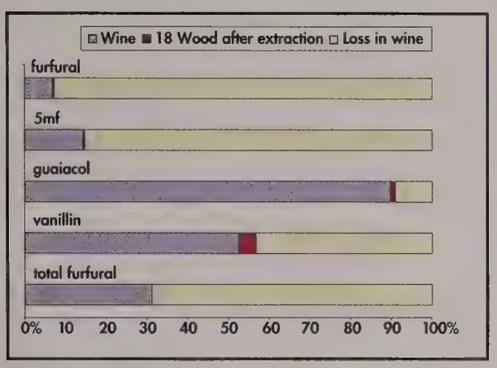

Figure 2. Balance of wood extractives in wine and losses due to transformation.

Is it the same as far as staves are concerned? The use of staves involves their immersion into wine. Yet it is well-known that wood permeability to liquids depends on the direction of penetration. It reaches its maximum in the longitudinal direction, which corresponds to the direction of the sap circulation in a living tree.

In contrast, it is very small in the direction perpendicular to the radial cut (barrel stave cut) – the face exposed to wine when using barrels. Therefore the different stave surfaces (end, length, etc) immersed in wine are not equivalent in terms of penetration depth. When using staves of different geometry, we will lose the proportionality of extraction rate in relation to the contact area.

For example, compare a thin and a thick stave (twice as thick), both of equal length and width. If we calculate the total surface of both staves, the values are similar, since the only difference is the surface of the stave extremities (the contact area will be slightly bigger with the thicker stave).

In order to calculate the percentage of extraction over the contact surface, the wine must penetrate into the whole surface of the stave at a similar shallow depth. Taking in consideration the anisotropy of wood, this is probably not the case. On the contrary, the wine will probably penetrate deeper into the wood in the longitudinal direction. The simple observation of staves used for wine ageing cut lengthwise shows that wine penetrates into the heart of wood (Figure 1).

In this case, the quantity of extracted wood compounds will be much higher from a thick stave than from a thin stave. If total penetration is considered, a thick stave will pro-

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duce twice as many extracted compounds as a thin stave because the mass of a thick stave is double that of a thin stave.

In the current study, we are trying to answer the question about the penetration rate of wine into a stave and its interaction with wood. If it is low, the extraction should be proportional to the surface, whereas if it is high, the extraction should be proportional to the mass of wood.

Equipment and Methods

Staves of 7 mm and 18 mm (Seguin Moreau, Cognac, France) were used in the study. Both types were made of French oak with medium toasting.

The staves were macerated in wine (Domaine de Chiroulet, Vin de Pays des Côtes de Gascogne, Tannat, 2011 vintage) separately (two individual tanks) for 7 mm and 18 mm, the dose being 10 g/L of stave in both cases (two staves per hectoliter for 18 mm and five staves per hectoliter for 7 mm). The

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staves were immersed in wine in April and removed in November (total contact time of seven months).

4-cm pieces were sawn off each stave, the samples were mixed together, and ground down to a 0.5mm powder. This procedure was required in order to obtain an average sample and reduce the effects of a possible toasting heterogeneity.

The wood powder was soaked by shaking (300 tours per minute) by the model wine solution (12% vol. alc, pH = 3.5) for 24 hours. The extracts were analyzed by HP-SPME-GC-MS according to the Carrillo method for main compounds created from wood toasting: furfural, furfuryl alcohol, 5-methylfurfural, guaiacol, and vanillin.[1]

After wine maceration (seven months), the staves were removed from the wine. A 4cm long piece was sawn from the central part of each stave. This time, we did not use the extremities since they might have been too exhausted in extractive compounds with the rest of the stave because of the lengthwise penetration of wine into the wood. This way we avoided the artifact risk of the trial.

The wood pieces were ground down, extracted, and analyzed following the method described above. The wines obtained during trials were also analyzed using the same protocol.

Results

We reviewed the compounds distributed between the liquid (wine) and the solid phases (wood after maceration) and compared them with the quantity of wood compounds before maceration. Given the absence of furfuryl alcohol in wood and its appearance in wine through the reduction mechanism for furfural, we defined the total furfural as a sum of furfural and furfuryl alcohol. Its concentration was compared with furfural amount in wood.

The balance of compounds shows us that the sum of compounds after maceration (wine and wood) is lower than their initial amount in wood before maceration. This fact could be explained by the transformation of such compounds in the wine medium and corresponds to the conclusions made by P. Spillman,[6,7] about the evolution of furfural and vanillin, and also to the phenomena reported by M.F. Nonier, which pointed out the interaction between wood aldehydes and wine phenolics.[4]

The amount of wood extractives (after extraction) in wine, in wood, and losses due to transformation are shown in Figure 2 (example of a 7 mm stave). All amounts were expressed in % of initial concentration in wood before maceration.

One can see that the rate of loss of compounds in the wine medium is spectacular, except for guaiacol, which seems to be stable. The fur-

fural, 5-methyl-furfural are very affected (loss of about 90%) by the wine medium, while there is just 50% of loss for vanillin.

If we only focus on the extraction of wood compounds (Figure 3), one can observe that the 7 mm staves contain less than 5% of the initial concentration of wood compounds, while the 18 mm staves contain 2% to 20% of the initial concentration depending on the analyzed molecule.

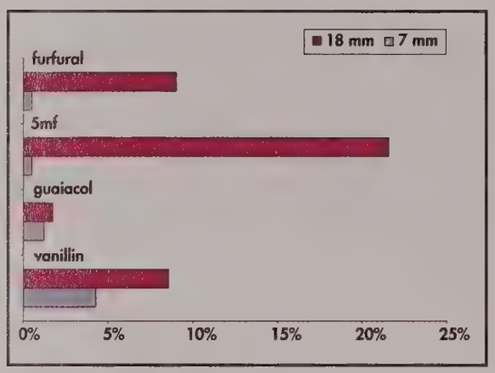

Figure 3. Percent of extractives of wood compounds into 7 mm and 18 mm staves.

This study shows that during maceration of staves in wine, the wood loses a significant proportion of its extractives. If we consider the amount of wood extractives leached by wine (difference between extractives in wood before and after maceration), we find approximately the same amounts for 7 mm and 18 mm staves taken at an identical dose (10 g/L), a small discrepancy arising only from a slight difference between extraction rates for these two types of staves (Figure 4).

On the other hand, if we consider the dose of staves in percent of surface (example of thin and thick staves), we have almost 2.5X as much equivalent barrel surface for the 7 mm stave than with the 18 mm stave. This means that a winemaker who takes into consideration the contact area would, in practical terms, use a dose of 2.1 staves (7 mm) to reach the result obtained with two staves of 18mm in terms of wood extraction, and must have made a mistake with the dose. This leads to a very important error as far as oak extraction and enological results are concerned.

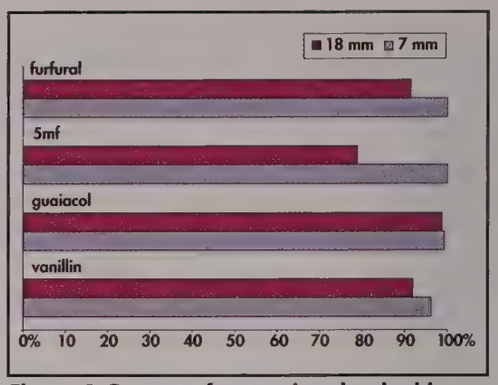

Figure 4. Percent of extractives leached by wine from 7 mm and 18 mm staves.

Conclusions

This trial shows that the way of expressing the wood dose for staves in g/L is closer to reality in enological terms than that expressed in terms of contact surface. This result is conditioned by the phenomenon of a very deep penetration of wine inside the stave (in all three direc-

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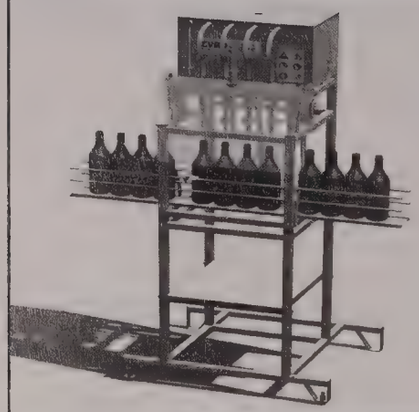
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tions: radial, tangential, and longitudinal) and consequently by a significant extraction of wood compounds (80% to 95%) during stave maceration; this phenomenon is different to those observed when using barrels.

The use of surface area still makes sense if the winemaker always works with the same type of stave. For example, by doubling the number of staves per hectoliter, he also doubles the surface area.

However this approach is no longer accurate if the winemaker uses different types of staves and in particular staves of different thickness. In this case, the use of the g/L approach is essential and enables the winemaker to avoid making errors of dosage and therefore enological mistakes. ■

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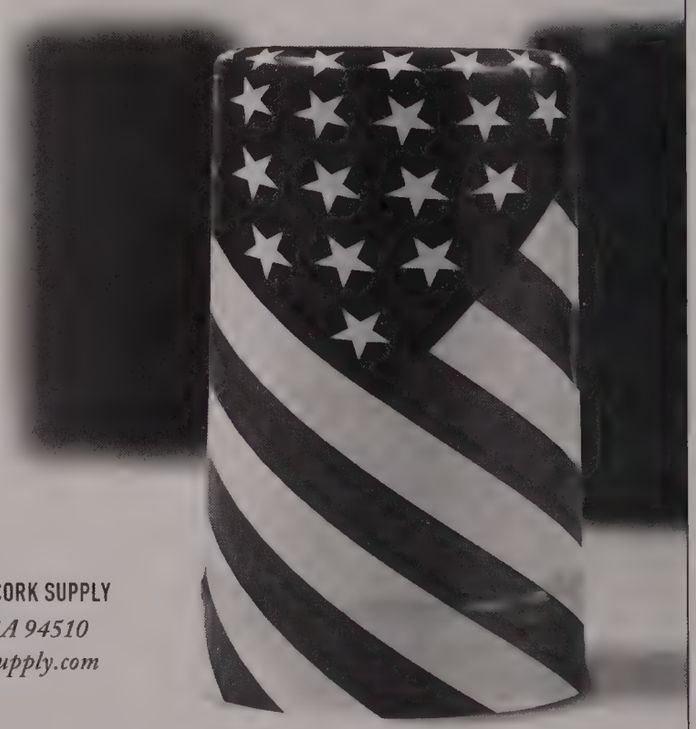

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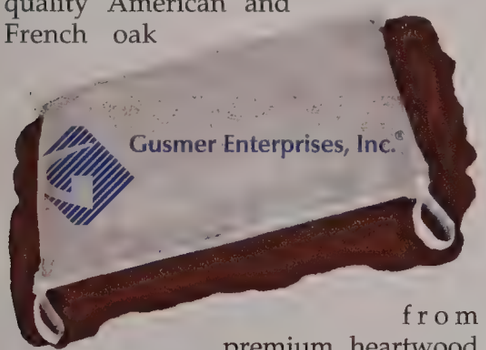

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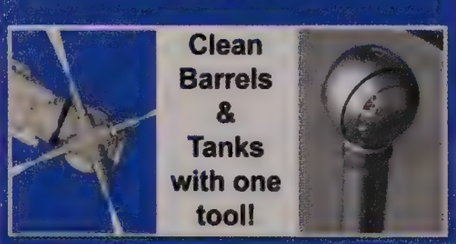

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WINEMAKING

PART ONE

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Cold stability of wine

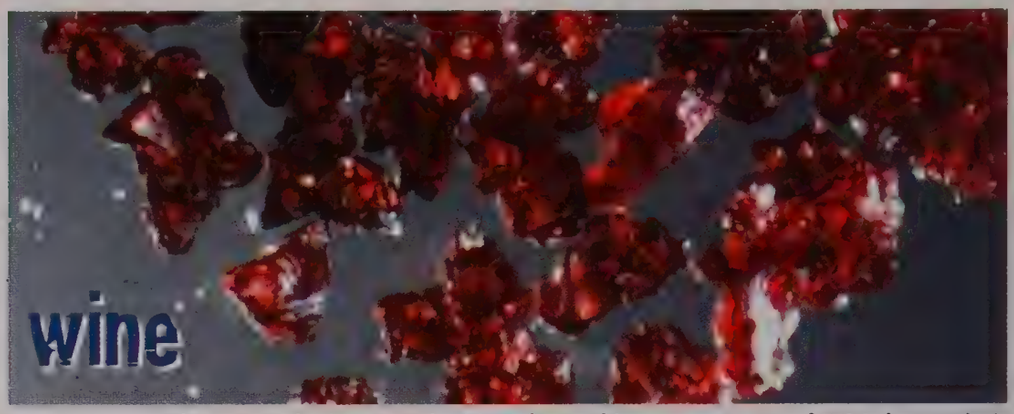


Photo-1: Red wine crystals, 20x (photos this page courtesy of ETS Laboratories).

BY Patricia Howe

Bitartrate and tartrate stability in wine is commonly referred to as "cold stability" and involves potassium bitartrate (KHTa) or (less commonly) calcium tartrate (CaTa) salts. The formation of these salt crystals is the universally recognized symptom of a wine which is not "cold stable." These crystalline instabilities are the focus of this article, as colloidal cold hazes are rare in wine.

A wine may be defined as "cold stable" if it does not throw a haze or sediment of crystals after exposure to cold, but there is little agreement on any uniform time/temperature parameters. Each winery tends to set their own definition based on the wines produced, the packaging, the expected shipping and post-purchase handling.

Photo-2: White wine crystals, 400X, idiomorphic flat crystal faces.

This varied approach to the stability parameters of wine is further complicated by the limitation of laboratory testing used to confirm stability. Wineries want a rapid, "in-process" laboratory test which accurately predicts the finished/packaged wine's response to given time/temperature exposure conditions.

Analytical performance of the precision and accuracy of the various laboratory stability tests are hampered by the lack of wine stability laboratory reference solutions in addition to a lack of uniform time/temperature parameters.

Any winery which has had to deal with presence of tartrate/bitartrate precipitation will appreciate that consumers may not able to differentiate the harmless crystals from broken glass (Photo-1). It is possible for a consumer to mistakenly trigger an investigation; broken glass is a "foreign material" per U.S. Department of Agriculture (USDA) and the Food and Drug Administration (FDA) definitions. Foreign material in food is one of the primary reasons for recalls (after mislabeling, unlisted allergens, and microbial contamination).

Understanding chemistry of bitartrate and tartrate crystal formation

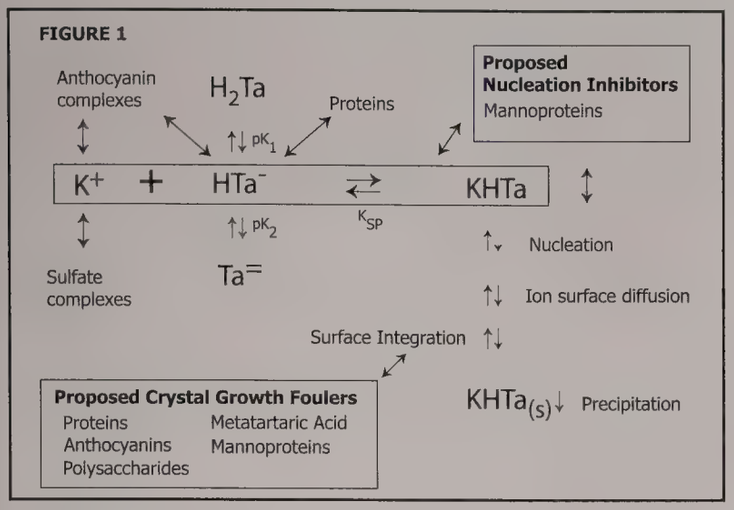
The multivariate nature of the formation of KHTa and CaTa crystals is dependent on several factors, including the chemical equilibria of multiple ionic and colloidal species, crystal formation and growth kinetics, and physical/chemical treatments of the wine. As a result, this is a frustrating, complex technical issue which has long been ripe for commercialized improvements.

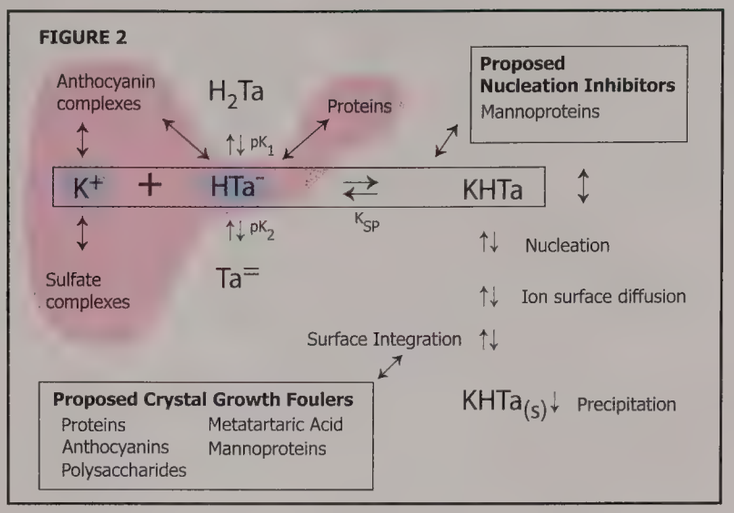
Over the past few years, several new options in processing or treatments have become available in response to this need. The risk and economic impact in choosing stabilization (and testing) methods, combined with limited resources or technologies at many wineries, makes these decisions difficult. A basic understanding of mechanisms behind these instabilities can be very important to choosing the best management method.

Recommended reading

For English speakers, several excellent reviews on the chemical sources,

Photo-3: White wine crystals, 400X, curved faces indicating macromolecular complexing.





stoichiometry of the ionic species, and the contributions of macromolecules are good for scientific and historical background, and for an introduction to the terminology involved.[15,18,19]

Additional reading on the studies involving the reactions kinetics for bitartrate (KHTa) and tartrate (CaTa) crystal formation and growth,[1,9,10a] and studies on the composition of crystal precipitations themselves in both laboratory and winery environs will add to the understanding of these crystallization issues.[15]

More recent studies have focused on yet another aspect, the contribution of "fouling" of crystals and the composition of naturally-formed crystals to evaluate non-KHTa components,[8,16,17] and the impact of colloidal components on cold stability,[6] and specific effects of mannoproteins and carboxymethylcellulose.[3,11]

The behavior of calcium tartrate has been found to have some differences from that of potassium bitartrate in wine,[7,12,13] especially with respect to the influence of temperature and time.

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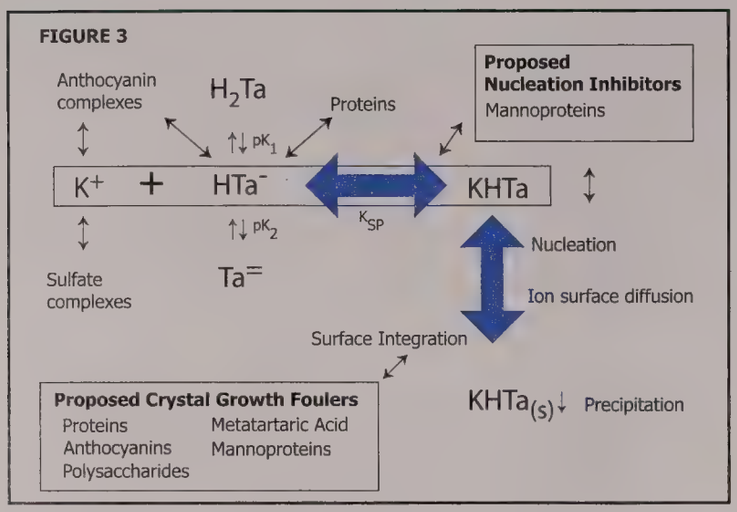

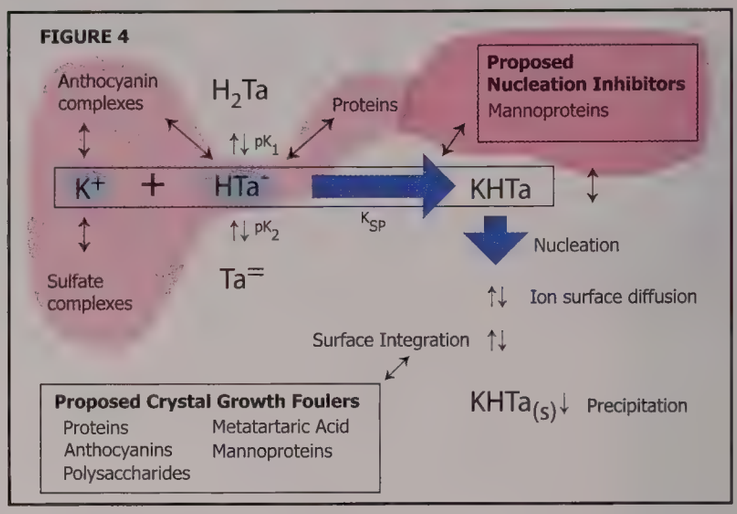

Summary of cold stability chemistry

There are two major aspects of the chemistry involved in the formation of potassium bitartrate crystals in wine: stoichiometry and kinetics (Figure 1). The chemistry of calcium tartrate is analogous in most cases.

Ionic concentration

The stoichiometry — the relative quantities — of the ionic constituents of both the KHTa and the CaTa salts are based not only on the actual concentration of the ionic species but also on their chemical interactions with a wide variety of other wine components. These other components are known as "complexing" compounds and consist of metals, pigments, acids, and proteins, and act through hydrogen bonding or competitive reactions.

The concentration product (CP) model for potassium bitartrate stability in a wine is based on the actual concentrations of these ions. The CP value for a wine is **always** higher than the theoretical solubility product (SP) — the maximum theoretical concentration before salt precipitation occurs — of the alcohol/water solu-

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FIGURE 5

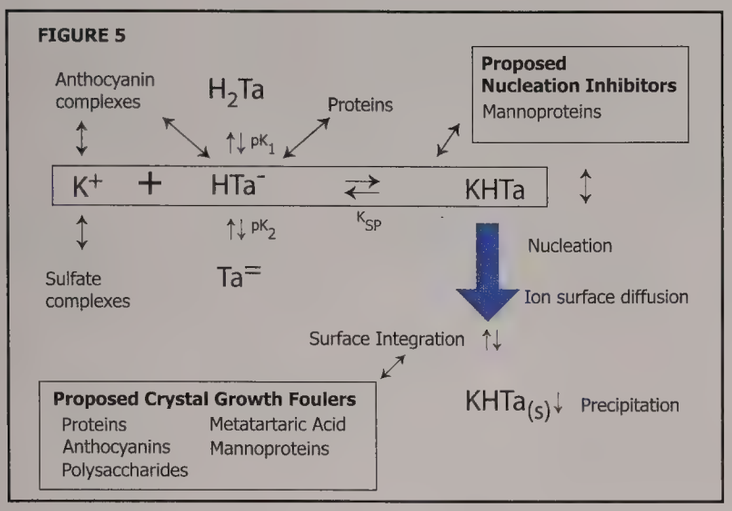
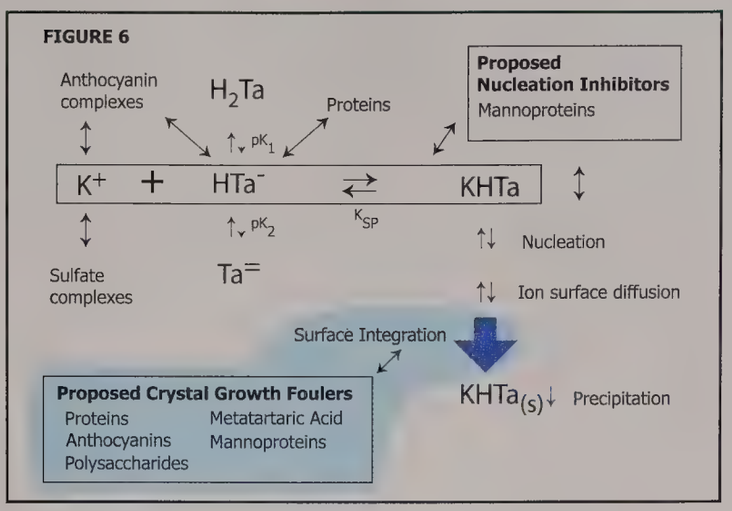


FIGURE 6



tion. This is because the complexing agents effectively reduce the available ionic concentration. As a result, even after various types of stabilization, the empirically- derived "acceptable" levels for CP values are still higher than the theoretical SP values.

If there were a way to determine the "uncomplexed" concentration of the species of interest, rather than actual concentrations, maybe the CP values from using these lower, "uncomplexed" values might correlate more closely with the theoretical solubility products values.

Crystal Growth

Despite not having complete analytical abilites to estimate the uncomplexed and available ionic concentrations, one can **infer** these active concentrations by maximizing the actual formation of the crystallized salts using a kinetic approach.

The kinetic aspects of the chemistry address formation of crystal nucleation sites and crystal growth. Nucleation will occur rapidly and spontaneously if the concentration product at a given temperature is

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known to be at a level sufficiently above the solubility product (or holding capacity) of the wine at that temperature.

On the other hand, concentration products could also be well above holding capacity for the wine but still be insufficient to provide the conditions necessary to drive the formation of natural nuclei. However this does not mean that instability would not still occur if additional time or external sources of nuclei were provided.

As a result, it is possible that two wines with greatly different ionic concentrations (one "more stable" and one "less stable") may respond differently to the same level of cold exposure because of these nucleation limitations. This can be overcome with the addition of nuclei in the form of KHT powder, or in the form of heterogeneous nuclei from bottle glass or cork/closure surfaces, or even from ice crystals.

This natural nucleation limitation appears to be a more significant factor with CaTa than with KHTa. As there are few options for artificial seeding CaTa and it takes longer for wines to spontaneously form CaTa crystals, this makes nucleation time the critical factor in testing and evaluating wines for CaTa stability.

Once nuclei are formed, the ions move to the surface of the crystal face. This depletes the region immediately next to the crystal of available ions unless adequate movement/flow is provided; diffusion across to the face of the crystal can be rate-limiting but can be overcome by providing mixing.

The last step of crystal growth is the integration of the ions into the crystalline structure. Integration can be limited by the size, shape, and charge of the ion, and by interfering substances which limit access to the crystal surface. Incorporation of the HTa- into the crystal is a little slower than incorporation of the potassium ion, due either to the relative size, or due to more "complexing" of molecules associated with the bitartrate ion, according to kinetic studies.

Tannins, proteins, polysaccharides, or other large molecules (also associated with ionic complexing) can "foul" the surface of the crystal and change the faces from sharp edges typical of idiomorphic "pure" crystals to more rounded shapes [see Photos-2 and -3], and prevent further crystal growth.

The representative figures for calcium tartrate would be analogous to those of potassium bitartrate with minor exceptions for pH and complexing.

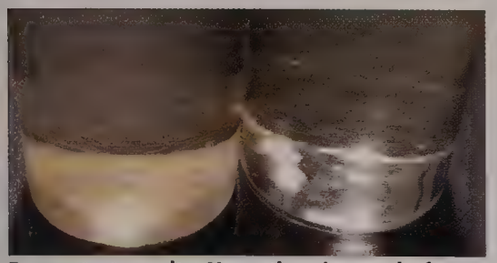
Five factors to consider when evaluating cold stability practices

There are five things from this review of the stoichiometry and kinetics of potassium bitartrate crystallization and stability which figure prominently in the evaluation of cellar treatments and laboratory testing. Consider how each of the five points are accounted for or controlled for any method for achieving or evaluating potassium bitartrate or calcium tartrate stability.

1. Actual versus available concentrations of ionic species ("complexing" factors) (Figure 2)

The concentration product value in a wine may not be directly related to the holding capacity of that wine if the K+ or the HTa- ions are complexed with macromolecules, metals, or other acids. There is no method to analyze for the actual activity of these two ionic species, only the actual concentration.

Ionic concentrations are functionally increased with decreasing temperature. Note that this temperature effect has less impact on the calcium and tartrate ions, and dropping the temperature has less effect on the ability to increase the apparent ionic concentration of CaTa; this is one of the major differences in KHTa and CaTa chemistry.



Freeze test results: Upon thawing and after 30 minutes at room temperature.

2. Crystallization goes both directions (crystals form, and crystals melt) (Figure 3)

Crystals are in equilibrium with the ionic species. This means that crystals can re-dissolve or melt back into solution, depending on temperature of the solution. This can be easily observed: perform a freeze test on a wine, pull the sample out of the freezer, and watch it melt. There will likely be crystals just at the point of melting which will disappear by letting the sample warm to ambient temperature; this will become more obvious as time passes. [see above photo]

3. Minimum available concentrations versus crystallization and kinetic energy (nucleation) (Figure 4)

To form crystals, there is a requirement for a minimum concentration of ions, a minimum energy, and a minimum time due to the kinetic limitations of the reactions. A wine may be stoichiometrically unstable but still not have adequate force to start nucleation in a reasonable time frame. The wine is unstable but may not show it quickly.

This energy and/or kinetic limitation can be overcome if nucleation sites — either homogenous through seeding or heterogeneous through contact with glass bottle or cork/closure surfaces — are provided., assuming that the wine is supersaturated. Seeding is a common approach to enhance KHTa crystallization, as finely powdered pure forms are available. However, pure CaTa powders are not commercially available and this is one of limitations to facilitating productions methods for CaTa stabilization.

4. Overcoming crystal diffusion limitations (crystal growth) (Figure 5)

Crystal growth can be optimized by providing adequate mixing (to allow the rapid diffusion of ions to the surface of the crystal face). Mixing is needed to reduce the boundary layer surrounding the crystal.

5. Restricting the fouling of crystals (crystal growth) (Figure 6)

Crystal fouling can occur when negatively- or positively-charged macromolecules obscure the charged surface from binding with the salt ions. This can slow crystal growth by affecting both diffusion and ion integration into the crystal structure.

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It is generally believed that this is how carboxymethylcellulose and meta-tartaric acid inhibit crystallization, but there are theories which allow for any charged macromolecule to cause crystal fouling and reduce the growth of crystals, in addition to the already mentioned effects of complexing the ionic species. ■

Limitation of lab practices

In the next article, we will review many laboratory "cold stability" tests available, and discuss theoretical goals and some time-tested and empirically-derived assessment standards to provide a starting point for any frustrated winemakers.

Part II in *Wines & Vines* April 2013 will include: "Evaluating laboratory methods for Cold Stability."

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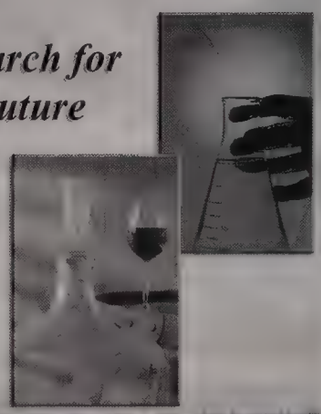
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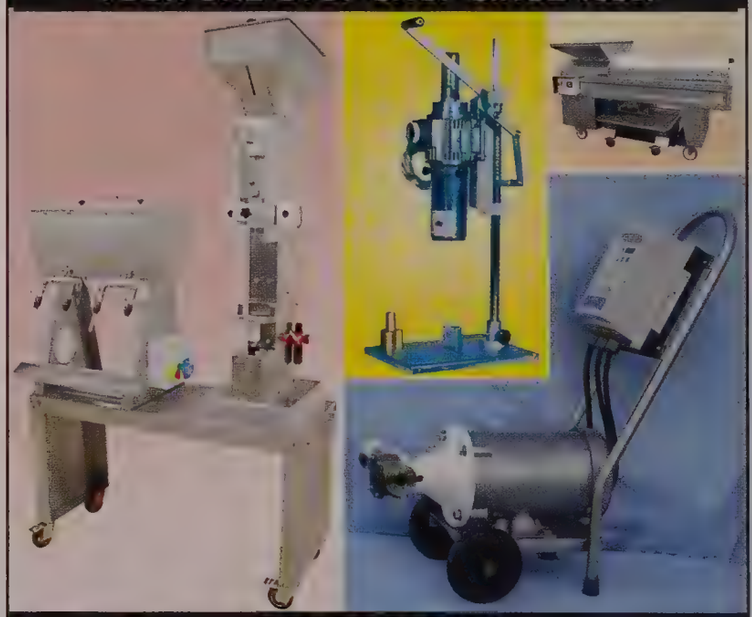
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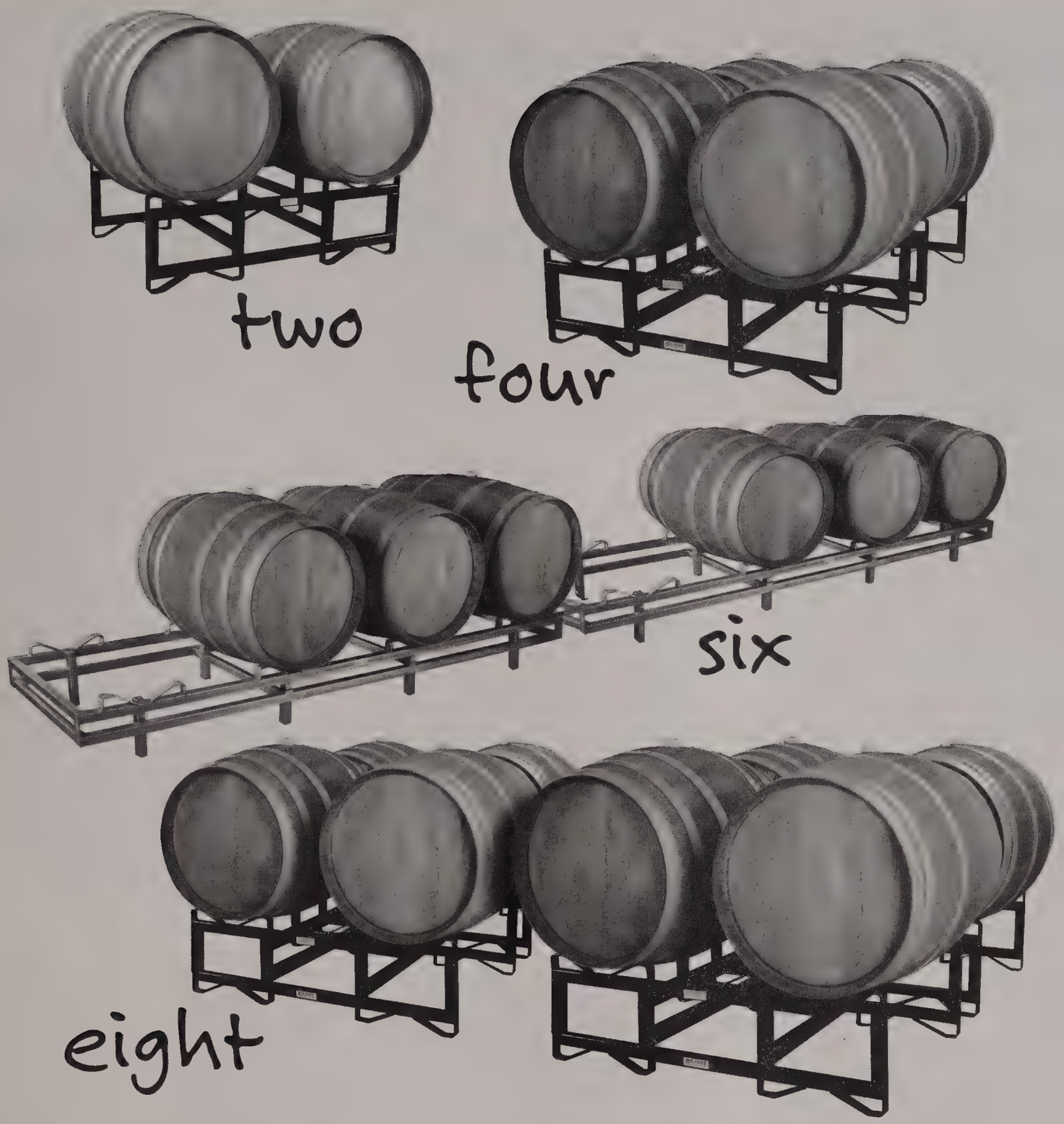

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BY Maurizio Ugliano,[a] Jean-Baptiste Dieval,[a] Evdokia Dimkou,[b] Jeremie Wirth,[c] Veronique Cheynier,[c] Rainer Jung,[b] Stéphane Vidal[a]: [a]Nomacorc France, Rodilhan, France, [b]Geisenheim Research Center, Section of Enology & Wine Technology, Geisenheim, Germany, [c]UMR 1083 Sciences pour l'Oenologie, INRA, Montpellier, France

Delivering wines that consistently fulfill consumers' expectations is a primary target of the modern wine industry. Due to today's rapid turnaround market, there is a growing interest towards winemaking practices for wines that are ready to drink when they leave the production facility.

However, even with these fast turnaround times, a period of several weeks or even months intervene typically between bottling and consumption of wine, during which wine sensory characteristics can change as a result of the different chemical reactions taking place.

In addition, in the case of high-end wines, a period of bottle ageing is often recommended, in order to achieve improved sensory characteristics. For this reason, some regional regulations impose a minimum period of bottle ageing, as is often the case for some Italian and Spanish wines.

Wine aroma is expected to increase after a period in the bottle, due to a complex mix of reactions involving acid-catalyzed release of some varietal aroma compounds and formation of certain sulfur compounds contributing, at moderate concentrations, to fruit aromas and chocolate/toasted empyreumatic notes. At the same time, tannin polymerization is expected to result in reduced astringency and improved overall mouthfeel. Overall, it is often said that wines reach an optimum after some time in the bottle, provided that adequate conditions exist, including having appropriate levels of oxygen.

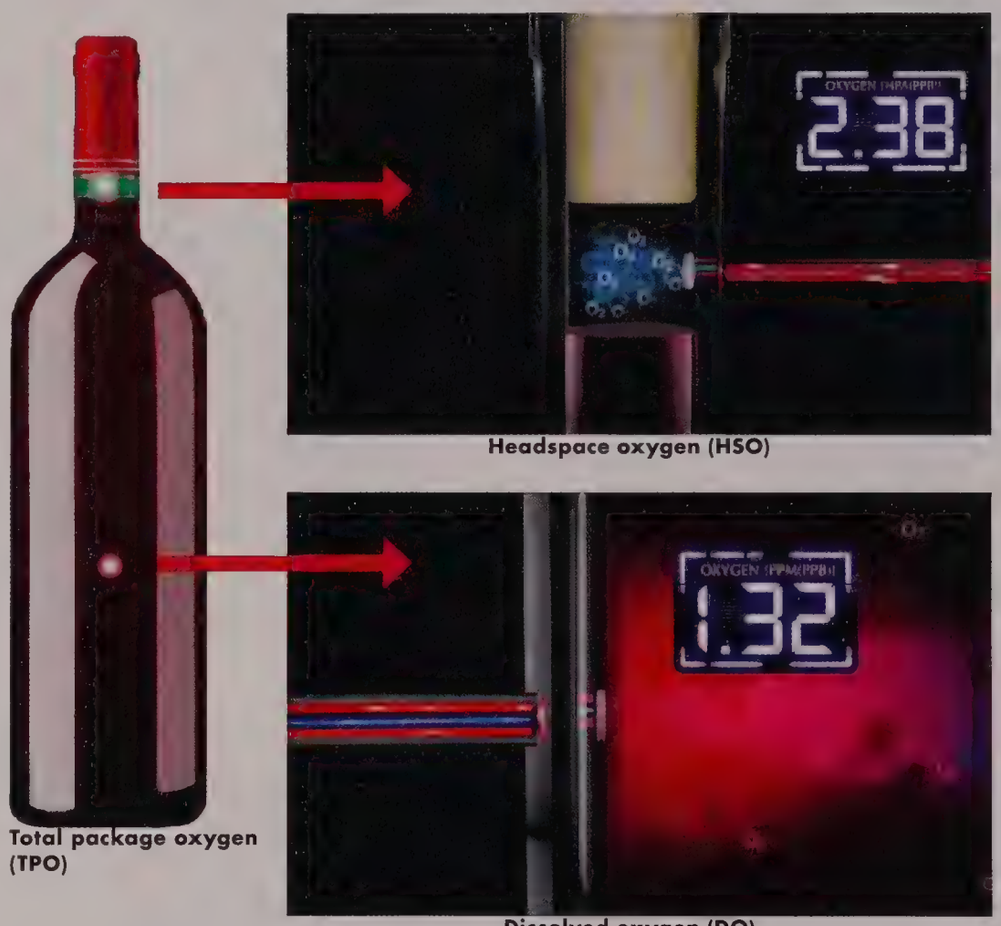

Figure 1: Oxo-luminescence technology for direct measurement of HSO, DO, and TPO in a sealed bottle.

During the last decade there has been a very intense debate in the wine industry regarding the importance of closure oxygen transmission rate (OTR) value, which was shown to be crucial to wine development in the bottle.[1,3,4,5]

The oxygen barrier properties of the closure can allow creating adequate levels of nano-oxygenation (oxygenation at extremely low rates) that appears to be needed for optimal aroma and mouthfeel evolution.

The range of closures currently available covers a rage of approximately 0.5 to 5 mg O_2 per bottle per year, and this range is thought to fulfill the oxygen requirements of most wines, in consideration of their expected shelf-life.

However, although very important, closure OTR is not the only factor influencing wine exposure to oxygen inside a sealed bottle. The recent introduction of the oxoluminenscence technology, which features

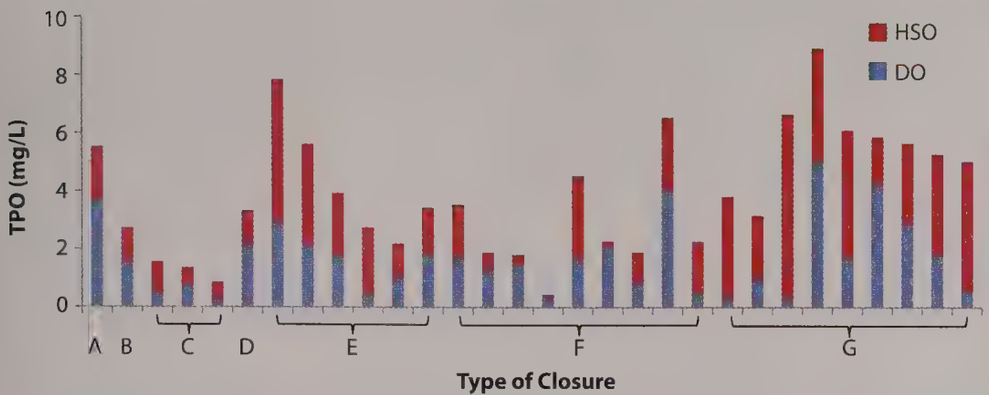

Figure 2: TPO values measured at bottling for diffrerent types of closures, also showing the proportion of dissolved oxygen (DO) and headspace oxygen (HSO). A: Agglomerated; B: Colmated; C: Injection-molded; D: Microagglomerated; E: Natural; F: Nomacorc; G: Screw cap.

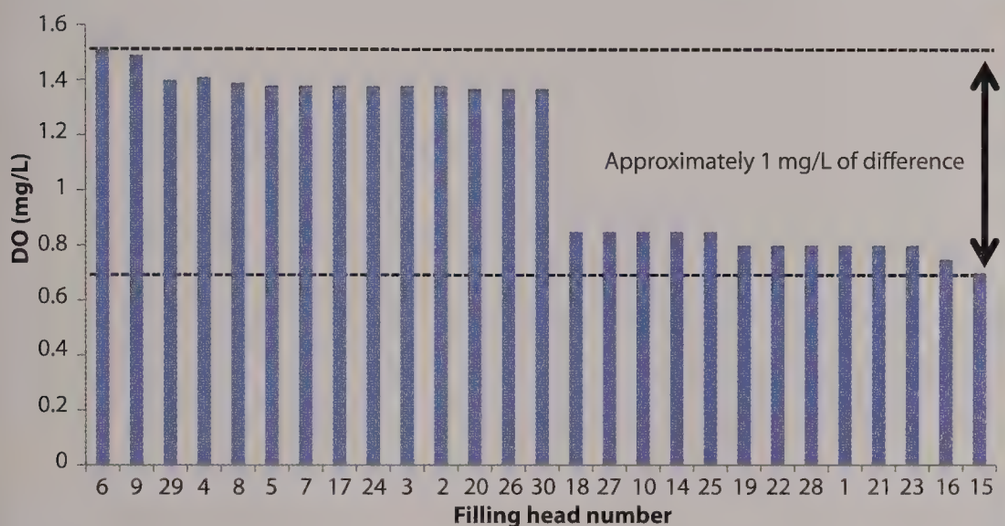

Figure 3: Variations of DO observed on different filling heads of the same bottling line.

remote oxygen sensors that can be placed inside the wine bottle (Figure 1), allows accurate quantification of oxygen inside a sealed bottle, nondestructively.

Figure 2 shows a set of data collected at different wineries by means of the oxo-luminescence-based Nomasense® oxygen analyzer, during bottling sessions using bottling equipment and closure types.

The amount of oxygen present at bottling, referred to as TPO (total package oxygen), can consist of several mg/L, in some cases reaching values higher than 10 mg/L. Considering that these values are equivalent to the amount of oxygen that will permeate through a closure over several years, it can be easily deduced that TPO represents a significant component of the oxygen seen by a finished wine in its entire life.

The following discussion is aimed to show the influence of TPO on wine evolution, illustrating how correct management of TPO is a key ingredient to achieve consistent post-bottling evolution.

Dissolved and headspace: components of TPO

Figure 2 also shows, for each of the TPO measures taken, the split between dissolved oxygen (DO) and headspace oxygen (HSO). While DO is often higher than HSO, this cannot be generalized, as several instances were found where, in spite of a low DO, TPO was still high due to high HSO. This is of great interest, given that most wineries tend to rely on DO measure to assess their overall ability to keep oxygen under control. While this is correct for monitoring of oxygen exposure throughout the winemaking process, when it comes to bottling performances, the measure of DO alone is obviously not sufficient anymore, and

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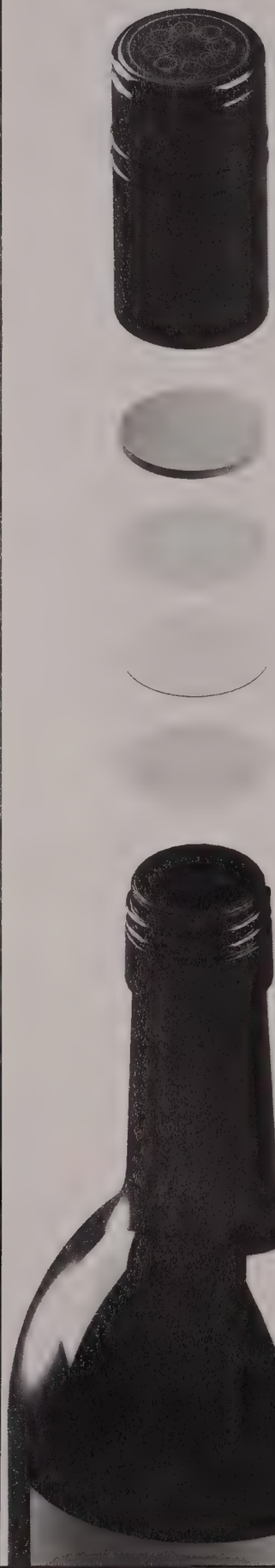

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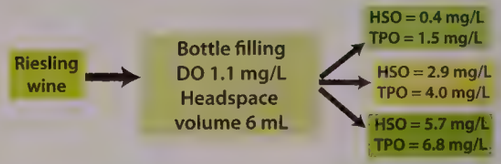

Figure 4: Experimental design used for the study of the influence of HSO on bottle ageing of Riesling wine. (375 mL bottles were used.)[2]

HSO should be taken into account.

From the data in Figure 2 it can be observed that too high TPO values can be common to all closures types, regardless of whether they are cylindrical (natural cork, agglomerated cork, synthetic co-extruded, injected molded) or screw cap. TPO values are linked to good conditions of storage and handling of the wine to minimize DO pickup prior to bottling, as well as to optimal functioning of inerting equipment at bottling.

It seems therefore logical that the type of closure has a secondary influence on TPO. However, a trend seems to exist in this dataset, with screw caps always being affected by relatively higher HSO (average HSO for screw cap 3.66 mg/L, compared to 1.54 mg/L for other cylindrical and 1.27 mg/L for Nomacorc). This reflects probably the fact that, in screw-capped bottles, headspace volume is much larger, and oxygen is more difficult to remove.

Additionally, the oxygen trapped under the screw cap can be conveyed back into the bottleneck upon application of the cap, further contributing to higher HSO.

From a practical point of view, excessive DO or HSO levels, although part of the same problem, have very different origins and require very different cures. Leaving aside issues of high DO related to inadequate storage and transfer conditions, DO levels in the bottle can often reflect oxygen pickup during bottling operation, for example at the level of individual filler heads. This can be the source of a relatively high variation in TPO at bottling, (see Figure 3).

Conversely, HSO values are linked to the performance of the inerting devices that are active on a bottling line (nitrogen sparging, vacuum, etc). Malfunctioning of these devices can

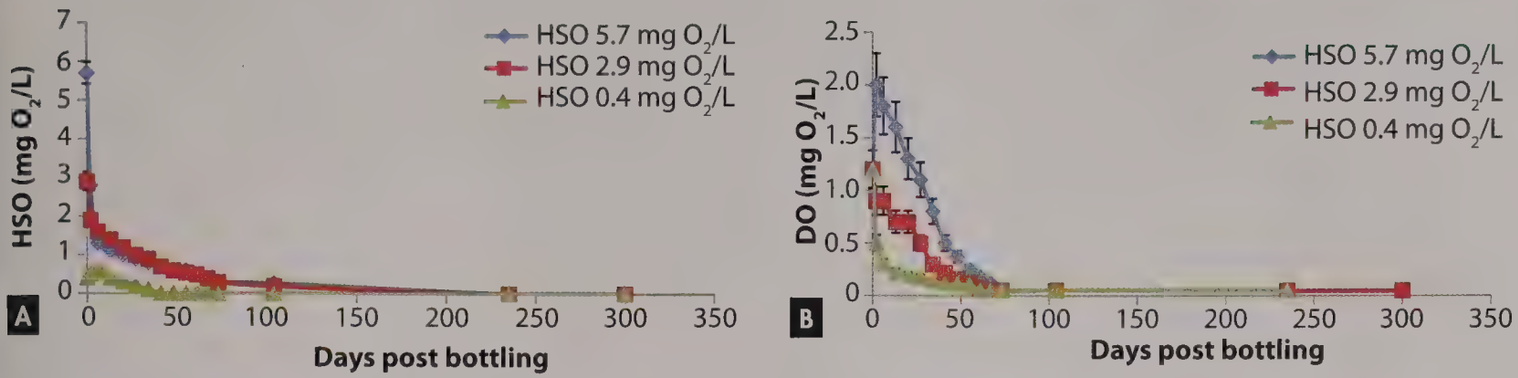

Figure 5: Evolution of HSO (A) and DO (B) in the bottles during storage. Initial DO was 1.1 mg/L in all wines.[2]

be rather common, but it is difficult to assess as it requires measuring the oxygen concentration in the headspace of a sealed bottle.

Oxoluminescence technology (Figure 1) can provide a valuable tool for the accurate diagnosis of the origin of high HSO and DO at bottling, as it allows non-destructive measure of oxygen inside the bottle.

Implications of TPO for wine post-bottling development

From the previous discussion, it appears clear that, from a quantitative point of view, TPO is a major component of the total amount of oxygen that a wine will receive while enclosed in the bottle. The question arises therefore as to whether above-average TPO levels can significantly affect wine shelf-life.

The influence of HSO management was investigated in a series of studies carried out by the Geisenheim Research Institute in partnership with Nomacorc. The experimental design adopted is shown in Figure 4. Wines were bottled with different HSO values by different degree of CO_2 flushing of the headspace.

The HS volume of 6 mL represents typical industry settings for cylindrical closures. However, as 375 mL bottles were used in this study, the levels of oxygen contained in these

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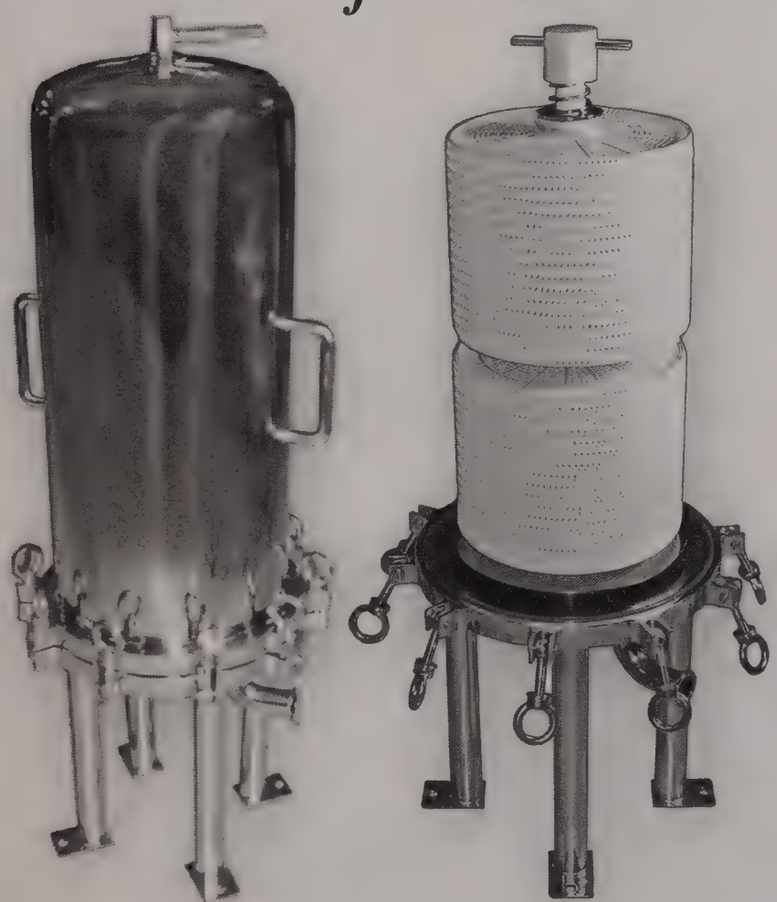

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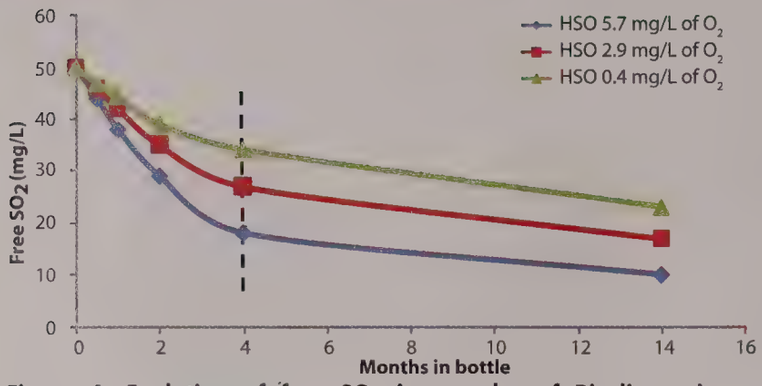

Figure 6: Evolution of free SO_2 in samples of Riesling wine bottled with different HSO. Initial DO was 1.1 mg/L in all wines.[2]

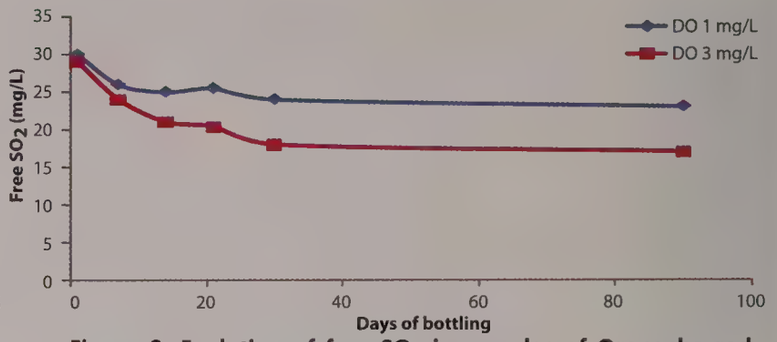

Figure 8: Evolution of free SO_2 in samples of Grenache red wine bottled with different DO.

headspaces (expressed in mg/L wine) would be 50% lower if 750 mL bottles were used. When HSO values are calculated for 750 mL bottles, final values of 0.2, 1.45, and 2, 85 mg/L wine are obtained for the three inerting levels.

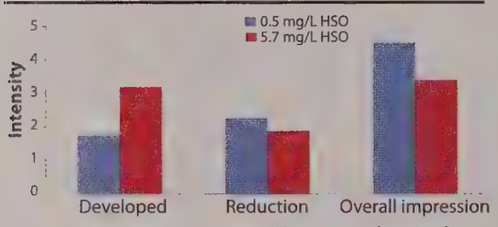

Figure 7: Sensory attributes of Riesling wines after 14 months of bottle storage. (375 mL bottles were used.)

It can be concluded that the range of HS oxygen concentrations in this study is similar to that found in other studies.[4] Therefore, although obtained in an experimental setup, the observations of this study provide meaningful indications regarding bottling management in large-scale winemaking.

Evolution of DO and HSO is shown in Figure 5. HSO decreased during storage in all treatments because of its dissolution into the wine and consequent consumption through different chemical reactions (Figure 5 A). In samples starting with 0.4 mg/L HSO, oxygen concentration in the headspace was completely consumed after approximately one month, while more than three months were needed to fully consume HSO in sample starting at 5.7 mg/L HSO.

Initial DO after bottling was 1.08 ± 0.15 mg/L across all modalities, and it decreased over the entire experiment (Figure 5 B). In samples with lower HSO, DO started decreasing immediately after bottling, whereas in samples with higher HSO oxygen, an early transient increase in DO was observed. This suggests that, during the early stages of bottle storage, in these samples the rate of oxygen dissolution into the wine was higher than consumption. This was only observed at 5.7 mg/L HSO, suggesting that, at 2.9 mg/L HSO, the rate of HSO consumption was higher than that of dissolution.

Changes in DO reflect the net balance between dissolution of oxygen from the headspace into the wine and consumption by the wine itself. Therefore, in general, the latter was higher than the former during the timeframe of the study.

Free SO_2 evolution was followed over time during bottle ageing (375 mL bottles were used for this study). Results for the three HSO levels studied are shown in Figure 6. Initial HSO (and therefore TPO) had a great influence on the decline of SO_2 in the first four months. HSO values of 5.7 mg/L resulted in a loss of free SO_2 of 32 mg/L (more than 50% of the initial value) in this timeframe, while with the 0.4 mg/L HSO, only 15 mg/L was lost.

The free SO_2 loss between four and 14 months of bottle storage was comprised between 6 mg/L and 8 mg/L, corresponding to about ¼ of the free SO_2 lost in the first four months under conditions of high HSO at bottling. This indicates that TPO at bottling plays a primary role in the evolution of free SO_2 in the first months after bottling, highlighting the importance of TPO components, such as HSO in this case, in wines for rapid consumption.

The direct connection between initial HSO and loss of SO_2 suggest that TPO management could be of primary importance to increase the shelf-life of low-SO_2 wines which are highly sought by today's consumers, including organic and biodynamic wines.

However, the importance of TPO is not restricted to short-term scenarios, as variations in TPO can result in changes in wine aroma profiles that will manifest after longer bottle storage. Sensory analysis carried out on the wines after 24 months of bottle storage at 14°C is shown in Figure 7.

Wines with the lowest and highest HSO levels were found to be different in the intensity of certain "aged" character (not noticeably oxidized, but not fresh anymore). Wines bottled with lower HSO have lower developed notes and higher overall impression. Differences in the "reduction" attribute were negligible.

DO is the other component of TPO, and differences in initial DO can also contribute significantly to inconsistent TPO values, potentially resulting in bottle-to-bottle variation. Most wineries are able to measure DO in the tank prior to bottling, and de-oxygenate the wine if needed. However, oxygen pickup can occur during transfer from the tank to the bottling line, and during filling operations, causing higher DO values in the bottle.

Figure 8 (from a study conducted at INRA Montpellier), shows the influence of initial DO variations on the evolution of free SO_2 in a Grenache red wine. An increase in DO from 1

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mg/L to 3 mg/L can result in a difference in SO_2 loss of approximately 6 mg/L after only one month of bottle storage.

If we compare these TPO values with the data in Figure 2 we can see that such differences in DO are not uncommon in the wine industry, and that even on the same bottling line a difference of nearly 1 mg/L can exist across different filling heads (Figure 3). Once again, these data highlights the primary importance of controlling oxygen at bottling in its different forms in order to ensure consistent evolution among bottles and prolonged shelf-life.

Conclusion

When it comes to wine post-bottling development, closure oxygen permeability (OTR) is not the only factor affecting the evolution of wine in the bottle. TPO (total package oxygen), namely the sum of dissolved (DO) and headspace (HSO) oxygen present at bottling can play a major role. Too much TPO, often resulting from excessive oxygen pickup during bottling operations, is associated with premature loss of SO_2, and uncontrolled TPO variations can influence significant variation between bottles.

Monitoring of TPO is crucial to reduce unpredictable variations during bottle storage, and could provide a help to ultimately reduce SO_2 addition prior to bottling. As TPO values at bottling can also influence wine sensory attributes after a period of time in the bottle, wineries should adopt adequate TPO monitoring solutions in order to deliver to consumers wines with consistent sensory and compositional characteristics. ■

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MICROBIAL BIOFILMS

A source of contamination throughout the winery

BY Michael S. Ramsey and David A. Mills
UC Davis Department of Viticulture & Enology

What Are Biofilms?

Biofilms are communities of microorganisms that attach to a surface, contain a support matrix of external polymers (often polysaccharides), and exhibit distinctive physical, chemical and physiological properties. Most biofilms exist as complex communities of mixed microbial genera and species and may be the more common growth state for all microbes in their natural environments.[1]

Biofilms also include both live and dead cells, which provide a source of nutrients as they decompose. In addition, layers of the external polysaccharide serve to trap organic molecules in solution concentrating nutrients in the three-dimensional ecosystem.[2] Biofilms have been studied extensively in food production facilities, beer and beverage plants, and in medically-related environments for the past 20 years.

Winemakers and brewers are often familiar with one type of biofilm – that which results in surface growth (termed a pellicle or velum) by flor yeasts.[3] Formation of a biofilm on winery surfaces by the yeast *Saccharomyces cerevisiae* was reported as early as 1995.[4] However, among the yeast and bacteria common to the wine environment, *Saccharomyces* sp. are comparatively poor biofilm formers. Indeed, current research focuses on improving the biofilm characteristics of *Saccharomyces* in continuous-flow fermenters typical in biofuel production.[5]

Despite research by related industries, relatively few studies have examined biofilm formation by microbes common to various winery surfaces. This is surprising given that winery-borne biofilms serve as a reservoir for spoilage microbes such as acetic acid bacteria and *Brettanomyces* species.[6,7] Most recent studies on winery biofilms have examined formation by various strains of *Brettanomyces bruxellensis*.[6] Enhanced biofilm formation resulting from yeast and bacteria (*Saccharomyces* + *Lactobacillus*) has also been reported.[7] A recent study of wine-related bacteria showed that mixed cultures of *Acetobacter aceti* and *Lactobacillus hilgardii* exhibited enhanced biofilm formation compared to either species examined in monoculture.[7]

Where do biofilms form?

In nature, biofilms are ubiquitous and form on all surfaces. In wineries, the surface in question might be stainless steel, glass, aluminum, or even nitrile and buna seals. Some of these surfaces are easier to clean than others. Although more amenable than many surfaces, cleaning stainless steel can be problematic. Even the material used for most wine fermentation tanks (T304 12 gauge stainless steel with a #2 finish), exhibits microscopic cracks, holes, and crevices where microbes easily attach.

Once the organisms have adhered to a surface, cells begin to proliferate and the production of polysaccharide matrices begins. The benefits to the organism of occupying a biofilm include greater protection from mechanical cleaning attempts, heat and ultraviolet radiation, desiccation, and penetration by cleaning agents.[7] Unfortunately, this protected biofilm is the likely source of microbial contamination in the winery and thus removing them is a priority.

Biofilms also show increased resistance to conventional sanitizers, such as ozone, acid anionic biocides (such as iodophors), and quaternary ammonium compounds, requiring higher concentrations of these sanitizers to kill microbes in a biofilm than the same cells growing in liquid culture.[7]

The reduced efficiency of antimicrobial agents is due, in part, to ineffective penetration of the biofilms' polysaccharide matrices by the sanitizers.[8] Another reason is the different level of metabolic activity among biofilm constituents, in some cases leaving those that are more quiescent, less sensitive to inhibitors than metabolically-active cells.

Moreover, when the organisms within a biofilm are killed, if the biofilm is not removed, the dead cell biofilm will provide a stable environment for renewed microbial growth, with a ready nutrient supply and secure places to attach.[8] The persis-

Figure B: Testing for ATP residues on a tank valve, after cleaning.

Figure A: One type of bioluminescence swab that is 100% recyclable.

tent nature of biofilms thus presents a serious challenge to the winemaker, to prevent contamination by potential spoilage microorganisms.

But I clean, isn't the biofilm gone?

As discussed above, there are a number of issues with killing and removing biofilms. If you are not testing, then you do not know if you have been successful. Typically, after a cleaning a winery might do microbial swabbing (from tank interiors, filter surfaces, or bottling lines for example) and plating on several different microbiological media to judge the effectiveness of the cleaning procedure.

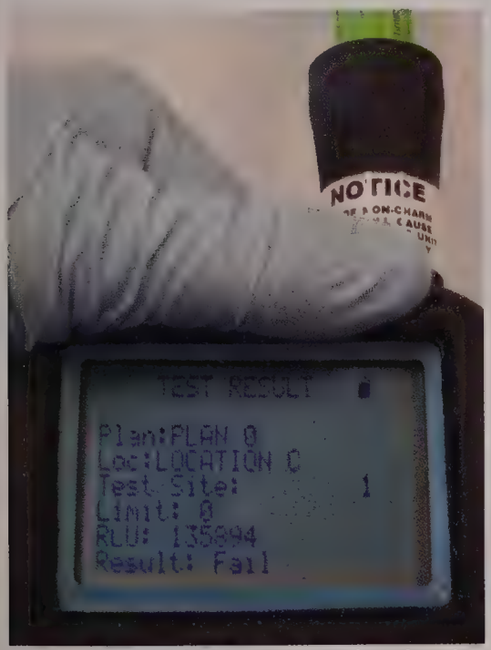
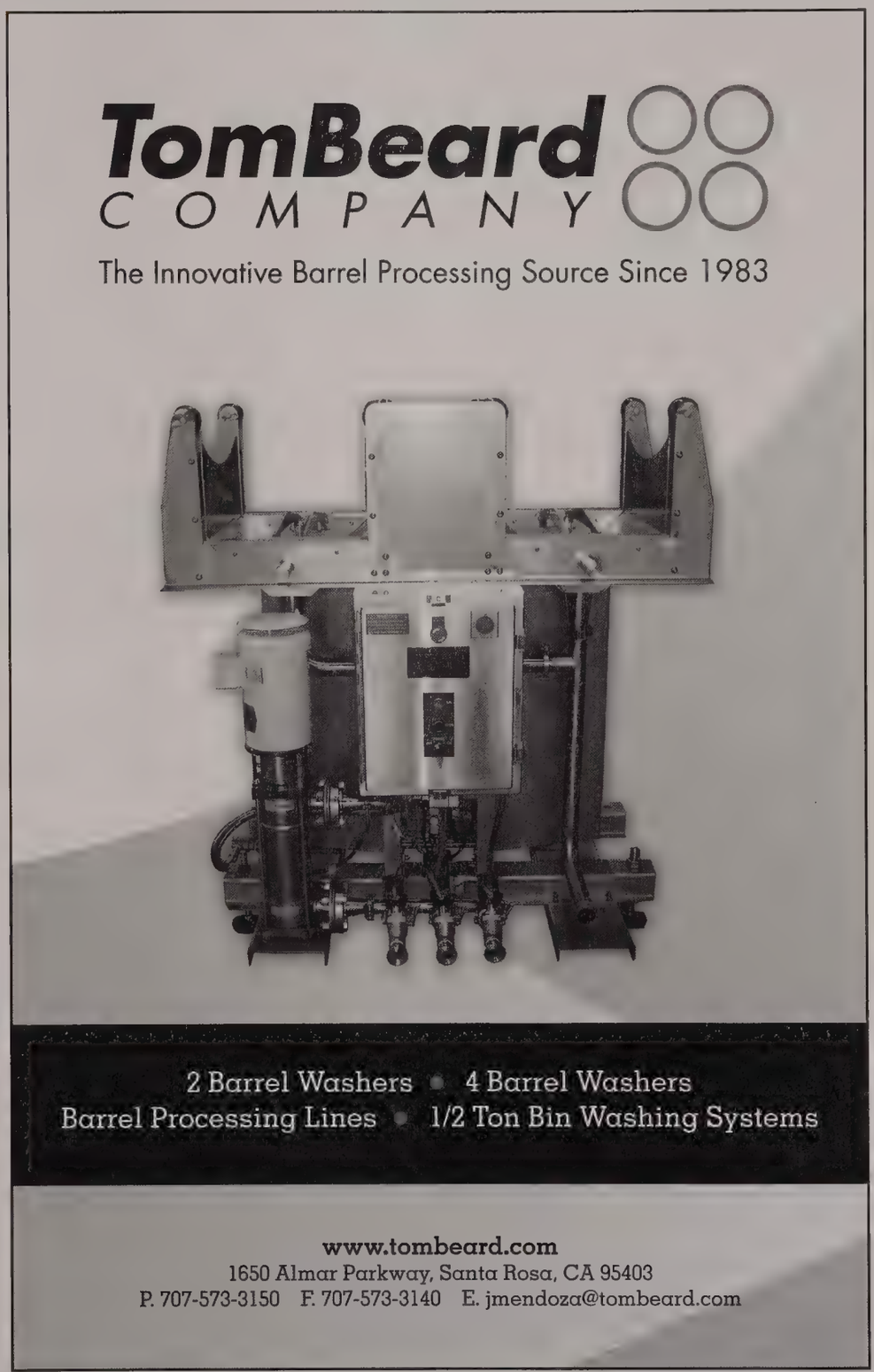


Figure C: Hand-held swab reader showing "Fail" result after swabbing.

In other words, this plating is used to determine how well the biofilms were destroyed and removed. Although this "traditional" swabbing can be very effective, growing the swabbed organisms will take time and there is always the problem with those organisms known as "viable non-culturable" that are metabolically-active but not able to grow on plates. In recent years, many large and mid-size wineries have adopted a technique that has been in widespread use in brewing, the dairy industry, and food processing since the early 1990s – ATP Bioluminescence.

ATP is short for adenosine triphosphate. This compound is the basic currency for energy in all living cells. The presence of this molecule may be assayed simply using an enzyme and coenzyme complex (luciferase/luciferin) found in the tail of the firefly, *Photinus pyralis*. The reaction is essentially the stoichiometric conversion of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The total ATP present on a swabbed surface can be extracted and assayed extremely rapidly (within five minutes). The breakthrough idea was to use ATP from all biological residues on a surface as an indicator of cleanliness, rather than try to ascertain the number of microorganisms present.

In addition, the residues do, in their own right, pose the problem of providing a nutrient source for the subsequent establishment and growth of biofilms. The light given off in this reaction is assayed as Relative Light Units (RLUs) – a measure of the light produced by the ATPase assay relative to a control sample taken from a clean (well scrubbed) surface.

How to use this technology in a small winery?

There have been attempts, since the introduction of this technology, to correlate RLU numbers with the number of cells that are found on the tested surface. The argument goes, if the level of ATP in bacterial cells is assumed to be relatively constant (a debatable assumption), the amount of light emitted during the reaction can be assumed to be proportional to the numbers of microbes present.

Even if this assumption were true, we have seen how the presence of organic materials (like juice or wine) will increase RLU readings without increasing the number of microbial cells present. The debate is ongoing.[9,10]

The good news is, you do not need to engage this debate to competently and confidently use this technology in a small winery quality assurance program. The actual results indicate the overall level of contamination of the surface because ATP from both food residues (wine and juice residues in our case) and from microbial sources will be detected.[8]

In general, more surfaces are identified as being "soiled" by the ATP test than by plate count because of this. There are many commercial products available to measure ATP bioluminescence. For reasons discussed below, they are not interchangeable, but all work reasonably well. The swabs are constructed in a way that keeps them dry and sterile inside a cylindrical container. (Figure A) Some brands of the swabs and containers are completely recyclable.

After swabbing the area in question (Figure B), usually about a 4-inch x 4-inch area, the swab is returned to the cylinder where it pierces a small container of buffer designed to dislodge the residue collected from the swab tip and, in some cases, neutralize any residual detergents or sanitizers. The luciferase (generally kept in the swab cylinder as a dry pellet), is reconstituted in this liquid buffer.

The key to this system is generally a small, hand-held swab reader. More

Table 1. Characteristics of cleaning agents used in experiment

Treatment	Concentration	Detergent	pH
Process water	N/A	N/A	8.69
Trisodium phosphate	0.5%	Alkaline	11.65
Commercial detergent #1	1%	Potassium hydroxide plus wetting and sequestering agents	12.96
Commercial detergent #2	2%	potassium hydroxide plus hydrogen peroxide	12.15

expensive versions have software, automatically capturing and recording data, and communicating with spreadsheets. Other, less expensive devices simply display the results. Regardless, the ability to use a handheld device to measure swab bioluminescence is a useful tool – enabling rapid assessment of surface contamination.

What do the results mean?

There are generally two results given, a number in Relative Light Units (RLUs) and whether this quantification indicates a "PASS" or a "FAIL" to the sanitation process. (Figure C) This "PASS" or "FAIL" determination (a specific number of RLUs) is somewhat arbitrary – as we will discuss – and is completely controlled and set by you, the quality manager.

In discussing how one would determine the "proper" PASS/FAIL number, we need to review the nature of RLUs and the information we would use to determine our PASS/FAIL point.

The important thing to remember about RLUs is they are not a standardized unit of measure such as length (inches or meters). RLUs are relative, depending on the exact formulation of the buffer and luciferin compounds, and some of the characteristics of the meter used for reading.

This is why, in addition to differing sizes and shapes, you cannot interchange swabs from different products or compare results from different systems. While each supplier has its own luciferin/luciferase formulation and instrument design, all systems are linear in response to ATP and have similar performances in terms of sensitivity and repeatability.

If RLU results from different companies, and sometimes even different systems of the same company, cannot be compared, what might affect the RLU quantification, (other than microorganisms and organic material). There are substances that may interfere with our results. Cleaning compounds, detergents, sanitizing agents, and even compounds like

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buna, nitrile, or polished stainless steel may interact with the enzyme buffer. These are small interferences and nearly always cause a small positive RLU value. This is troublesome, but not difficult to deal with. You simply need to test all the cleaning and sanitizing agents you use, in addition to the different surfaces you will include in your testing program.

As an example, many protocols will test solutions such as sanitizers and detergents by pipetting a 10 µL aliquot onto a swab and reading the swab. Let us say you use a 2% solution of potassium hydroxide (KOH) as a cleaner and a 100 ppm solution of peroxyacetic acid (peracetic acid or PAA) as a sanitizer. Using a separate swab for each, you would pipette 10 µL of KOH and PAA to the swabs, activate the swabs, and put the swabs in the reader.

Any interference will display as a positive RLU number (there are some rare negative interferences that have been documented by other food industries but we will not discuss these for the purposes of this article). Record this value, even if it is zero, for future reference. It is also a good idea to do this test with your process water, as some water – borne minerals have been known to cause positive RLU readings.

Table II. Tainless steel coupons with *Brettanmyces* biofilm cleaned and tested

Detergent	Number of "Pass" Tests	Number of "Fail" Tests	Fail Rate
Process water	0	4	100%
TSP	0	3	100%
Commercial detergent #1	2	1	33%
Commercial detergent #2	1	2	67%

In order to set the baseline of what is "clean," we can swab well-cleaned portions of our winery stainless, buna, nitrile, etc., and add up all RLUs contributed by these readings. This sum is your "PASS"/"FAIL" cut-off number. This somewhat arbitrary nature of the PASS/FAIL number will be different for everyone and every system. You do not need to test these materials regularly – you only need to test one time to establish the baseline. However, any new materials brought into the winery will need to be tested when they are introduced.

Sometimes, your swabs can pick up oxidized metals from tanks (especially welds) or worn material from gaskets, etc. This will cause the swabs to look "dirty," but does not contribute to RLU counts because this material is actually clean.

RLU readings above the number you have chosen (based on the sum of your interferences) would be "FAIL" events in your cleaning/sanitation program. As an example, in our classroom experience (see below), the sum of our interferences was 1,000 RLUs. So our "PASS"/"FAIL" number is 1,000 RLUs. Any RLU value on a swab (in our experiment) that reads above 1,000 indicates contamination of the swabbed surface, or an **insufficient** cleaning procedure. Remember, your number may be higher or lower.

Some wineries assess the risk involved in setting the "FAIL" number slightly higher than the sum of the interferences. In other words, these wineries are willing to allow a certain level of contamination. Generally, these wineries allow more risk in places like fermentation tanks (or floors) than they do the bottling line.

This strategy is not universal, but it is done. You, as the Quality Manager, decide on the level of risk your winery can tolerate. Regardless of the fail number, wineries we have spoken with will re-sanitize areas that "FAIL" until there is a "PASS" result.

Activating most ATP swabs in direct sunlight will cause an increase in RLU readings. If you are sampling outside, be sure to return to the lab before activation and reading. It is usually best to keep both the used and unused swabs out of sunlight as much as possible.

The "relative" nature of the numbers (given in RLUs) and the different effects of different interferences (discussed above) are two factors, among others, contributing to the lack of a standard protocol adopted by related food and beverage industries. Indeed, every winery has its own protocol for

ATP swabbing as well. Some wineries only use this technology on their packaging lines, while others also incorporate it into their cellar cleaning practices.

Classroom experience (UC Davis)

We have been using ATP bioluminescence in the UC Davis Dept. of Viticulture & Enology "Wine Microbiology" class experiment on biofilms for several years. Since the class occurs during Winter Quarter (when there is a minimum of activity in the Research and Teaching Winery and no incoming grape juice), we simulate sanitation conditions using 20 mm x 80 mm coupons made from T304 12 gauge stainless steel with a #2 finish (Figure D; provided by Santa Rosa Stainless Steel) that are smaller than the normal area swabbed but very easy to use experimentally.

Figure D: Stainless steel coupon for sanitation simulation.

This exercise is designed to illustrate to the students how microbes produce biofilms that may adhere to surfaces even after washing with a detergent/cleanser. We test several different commercial cleaners (detergent/cleansers) in addition to a control water wash. Class data is combined and used to determine cleaning efficacies. The exercise introduces students to the concept of swabbing and interpreting bioluminescence data, and cleaning effectiveness of water versus some commercial cleaners.

The experimental biofilms (*Brettanomyces bruxellensis* was used in 2011) are grown on sterile coupons soaking in grape juice over a 10 to 14-day period. Before class on the day of the experiment, the coupons are sterile-rinsed and placed in 50 mL tubes. Student groups are

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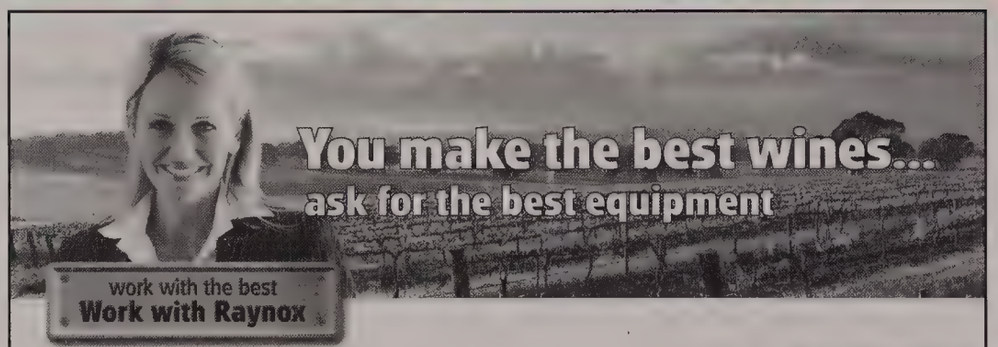

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then assigned a "cleaner" – process water (municipal), a mild TSP solution, and two commercially available, commonly used winery cleaning agents (Table I). In the interest of safety and logistics, the cleaners are all presented at room temperature. However, this allows for an informative discussion of proper application of winery cleaners, use of personal protection equipment, the benefits of Clean-In-Place technology, and even the performance of a good spray ball.

The coupons sit in the cleaner for 20 minutes. After a brief training session in swabbing, the students then rinse their coupons with sterile saline water, swab, and present their swabs for reading. Table II has sample class results.

In a commercial setting, the "FAIL" result would immediately trigger a re-sanitation event. Since no sanitizers are used in this experiment, for simplicity, discussion of proper sanitation occurs along with discussion of "false negatives." False negatives, as with all swabbing, occur when swabbing is done incorrectly. In the case of ATP swabs, these tend to be caused by insufficient swabbing (too small a testing area or, typically, not enough hand pressure).

False positives can occur if your cleaner or sanitizer (or sometimes the surface component) reacts with the ATP buffer. This must be carefully determined beforehand and, as discussed previously, if a factor, allowed for in the Pass/Fail determination.

All ATP-Bioluminescence systems have a limit of detection (LOD) that is the sensitivity of a system. No system can presently detect 100% of all ATP present. The lower the limit of detection, the more sensitive a system will be. Generally, LODs decrease as the price of the unit increases. You will need to decide how much sensitivity fits into your budget.

Do not forget to purchase the appropriate kit of standards. These kits typically contain an absolute zero standard and a standard of a known RLU reading. Without these two references you will not know if your reader is functioning properly.

The Good, Bad, and Sanitized

Biofilms are difficult to remove from winery surfaces and environments due to the biofilm's support matrix of external polymers and the difficulties associated with cleaning complex winery equipment and wine and grape processing environments. Therefore, a large part of biofilm control relies on the implementation of effective cleaning and sanitizing procedures and effective means to judge sanitation efficacies.

The adoption of ATP Bioluminescence technology has paralleled the development of HACCP (Hazard Analysis and Critical Control Points) and ISO quality programs in large wineries as an effective response. However, this should not dissuade a small winery from also adopting this technology. Neither should every winemaker be concerned with the lack of a strict, universally-applied, protocol.

These are easily adaptable technologies with, potentially, low startup costs, that are well within the capacity of a Quality Assurance program at a small or medium size winery. The swabs have a much longer shelf-life than media plates. The speed of detection may also, in some cases, reduce costs by ensuring efficient cleaning processes, helping to minimize the amount of cleaning and sanitation chemicals needed to properly sanitize equipment, and by providing rapid results that require immediate corrective action.

A distinct protocol is easy to develop and the method is simple enough to use that most winery workers can perform the test. The method is also often used in conjunction with traditional plating of surfaces and line samples for added quality assurance.

Although the ATP bioluminescent assay is very rapid, it is not very specific. The results tell us nothing about the nature of the contaminant, whether it is juice, wine, random organic matter, or microorganisms. However, these assays are sensitive, direct, objective tests of cleaning efficiency and risk.

If your QA strategy is to provide quick and sensitive answers to your winery cleaning efficiency, or your bottling line sanitation requires "zero" contaminants regardless of the nature of that contamination, ATP Bioluminescence assays might just be for you. ■

Read more on biofilms:
http://www.biofilm.montana.edu/
http://www.industrialbiofouling.com/biofouling_winery.html

ACKNOWLEDGMENTS

We would like to thank Lucy C.M. Joseph and Zoran Ljepovic for their help in putting this article together. We also acknowledge the past students of the Dept. of Viticulture & Enology Wine Microbiology Laboratory class who, over the years, have helped us develop this laboratory exercise.

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Photo: Merry Edwards Winery, Sebastopol, CA: tanks by Westec Tank & Equipment

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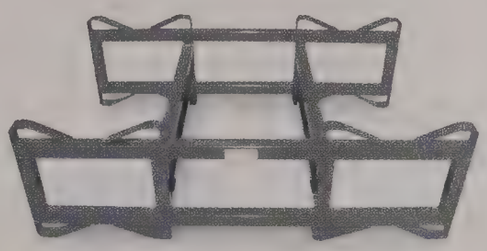

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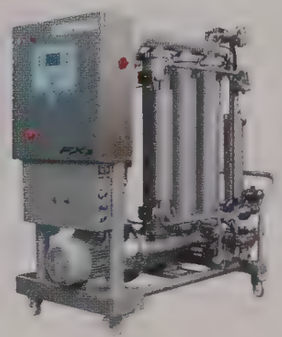

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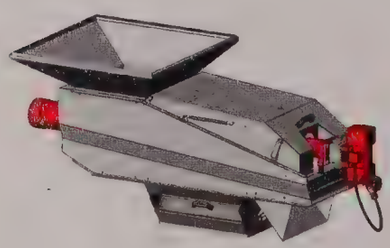

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The Topchock™ barrel saddle eliminates the hard-to-coat wedge shape of other saddles, along with the rust which inevitably forms. The new saddle is lighter and stronger as well, making racks easier to handle. The Topchock is the Topco standard, but other saddle types (Eastern and Western cradles) are available at no extra cost.

Topco Inc.

For refurbished racks, Topco removes the old powder coat and rust, and inspects racks for any damage. Then the racks are given a double sealing of fresh powder-coat. Single cross bar racks can be remanufactured to become double cross bar racks, and 2-barrel racks can become 4-barrel racks, at an economical price.

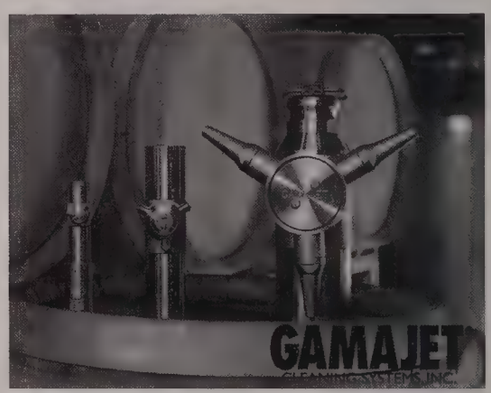
The Topco website shows a range of rack styles, sizes, and color choices.

For more information, contact:
Topco Inc.
974 Griffin St, Grover Beach, CA 93433
tel: 888/473-2005
e-mail: topcoinc@aol.com
website: topcoproducts.com

GAMAJET CLEANING SYSTEMS

Gamajet tank cleaning machines offer fast and efficient cleaning of barrels, tanks, and totes. The fluid-driven machines scour the entire interior in a 360-degree pattern, eliminating cross-contamination, microbial growth, and stubborn tartrates.

Tank cleaning machines: For cleaning tanks up to 75 feet in height, the Gamajet E-Z8 will work with most transfer pumps to create a closed-loop tank cleaning system. Entering through the manway on a cart, or from above on a hose or lance, the Gamajet machine will scour the entire tank interior, removing stubborn stains and tartrates. With a Gamajet, winery personnel can clean a tank in under 30 minutes, without climbing into the tanks to scrub and power-wash them.



Barrel cleaning machines: Leaving the barrels in the preferred position, stacked or racked, the fluid-driven machines, connected to a standard pressure washer, enter through the bunghole. In under four minutes, the machine will have indexed in a 360-degree pattern, scouring all parts of the barrel. Designed to produce at least 5 pounds of force on the barrel interior, the machine easily removes tartrates without harming barrels. At a rate of only 4 gallons per minute to clean a barrel, less than 12 gallons of water are needed.

For more information, contact:
Gamajet Cleaning Systems
604 Jeffers Circle, Exton, PA 19341
Toll-free: 1/877-Gamajet
tel: 610/408-9940; fax: 610/408-9945
e-mail: sales@gamajet.com
website: www.gamajet.com

PLEASE SEE GAMAJET AD, PAGE 18.

PAUL MUELLER COMPANY

Established in 1940, Paul Mueller Company designs and manufactures stainless steel processing systems and equipment reflecting the superb craftsmanship and strict attention to detail that make its products desired among prominent winemakers.

Mueller® tapered wine tanks, available in insulated or single-wall versions, have a novel design that allows the grape cap to wedge into the upper part of the tapered shell, making it easier to re-submerse, which, in turn, enhances the extraction process.

Mueller fabricates and field-installs equipment for all phases of winemaking, including fermentation, storage, champagne, de-juicing, and pomace removal tanks; rotary fermentors; Porta-Tanks®; Accu-Therm® plate heat exchangers; falling film chillers; stainless-steel wine barrels; Temp-Plate® heat transfer surface; process piping; modular systems; and integrated systems.

Mueller will custom design and build the specialized equipment required for any winemaking process. Ask about Mueller field fabrication capabilities. When a project is too big to ship in one piece, or is located in tight quarters, Mueller Field Operations can make it work.

MUELLER

For more information, contact:
Paul Mueller Company
1600 W. Phelps St., Springfield, MO, 65802
tel: 800/Mueller (683-5537)
e-mail: processing@paulmueller.com
website: www.paulmueller.com
PLEASE SEE PAUL MUELLER CO. AD, PAGE 14.

ENARTIS VINQUIRY

Enartis Vinquiry, part of the Esseco Group, a world leader in the production of winemaking products, offers Enartis fermentation and specialty winemaking products, along with winery equipment, labware, and chemicals. Three equipment highlights for 2013 are:

Enartis MicroOx is an oxygen doser for micro and macro oxygenation that accurately measures oxygen flow. Compared to other systems, Enartis MicroOx doesn't have a dosing chamber, but rather a high-accuracy sensor that measures oxygen flow rate in real-time. A microprocessor makes required calculations in order to maintain oxygen flow rate at the desired value, automatically adjusting the dosing rate for any variations.

Check Stab a2012 Life is a completely automatic analyzer for tartrate stability for small to large wineries. The instrument also has an automatic KHT dispensing system. The connection of the analyzer to a computer is done by means of a LAN.

Enartis VINQUIRY

Biolan Multiparametric Biosensor is an innovative instrument for analysis of different parameters in juice and wine. Test results are available within five minutes with a high degree of precision and accuracy. Biotests are currently available for L-malic acid, glucose + fructose, gluconic acid, lactic acid, and histamine.

For more information, contact:
Enartis Vinquiry
Main Branch: 7795 Bell Rd., Windsor, CA 95492; tel: 707/838-6312; fax: 707/838-1765
e-mail: info@enartisvinquiry.com
website: www.enartisvinquiry.com
Napa Valley Branch: 1282 Vidovich Ave., Ste. C, St. Helena, CA 94574; tel: 707/967-0290
Central Coast Branch: 2717 Aviation Way, Ste. 100, Santa Maria, CA 93455; tel: 805/922-6321
Paso Robles Branch: 1850 Ramada Dr., Ste. 3, Paso Robles, CA 93446; tel: 805/591-3321
PLEASE SEE ENARTIS VINQUIRY AD, PAGE 45.

CHART INC.

Chart Inc. is a leader in liquid nitrogen (LN2) delivery systems for oxygen displacement. Chart has worked exclusively with winemakers to integrate and optimize technology on screw cap bottling lines, to reduce headspace oxygen, and extend shelf-life of wine while preserving taste.

Chart's technology has consistently provided 90% – 95% reduction in headspace oxygen content, and 59% reduction in total package oxygen, compared to traditional gas nitrogen sparging. This consistency allows winemakers to confidently control the use of sulfur dioxide while maintaining an acceptable free sulfur dioxide level.

One winemaker reported dissolved oxygen content less than 0.03 ppm without compromising the fresh fruit taste of the wine, with Chart's dosing equipment.

CHART®

Chart has a complete line of stand-alone dosing systems to accommodate a variety of bottling line conditions and speeds. A precise dose of LN2 is injected into the headspace prior to capping. The liquid dose warms and turns into 700 parts of gas, displacing O2 from the headspace. With more than 1,000 dosing systems installed, Chart has a wealth of application-specific knowledge.

For more information, contact:
Chart Inc.
161 Baypointe Parkway, San Jose, CA 95134
tel: 800/371-3303; fax: 408/577-1567
e-mail: ln2dosers@chart-ind.com
website: www.chartdosers.com
PLEASE SEE CHART INC. AD, PAGE 17.

EURO-MACHINES, INC.

In today's economic times, the Europress is a wise long-term investment for any winery, large or small. Its consistently high trade-in value is an added bonus when you are ready to upgrade to a larger press. Manufactured in Germany, under the highest standards, the Europress is a "workhorse" that serves to make the best wines – the best for the best!

Other quality winery equipment offered by Euro-Machines:

All-stainless steel tanks (open top, multi-chamber, and storage), available from 25 to 25,000 gallons.

Conveyor belts, with the following standard features:

- » Open construction for easy cleaning;
- » All stainless steel;
- » Variable frequency drive for gentle motion, with motor mounted on top for better leverage;
- » Conclave belt cleats;
- » Customization available for specific winery needs.
- » Sorting tables with customization;
- » Destemmer-crushers, ranging from 3 to 40 tons per hour;
- » Pumps;
- » Mixers.

Euro-Machines, the U.S. subsidiary of Scharfenberger Company of Germany, is committed to excellent customer service. Factory-trained technicians are always happy and available to assist if needed.

For more information contact:
Euro-Machines, Inc.
WEST: 497 Edison Court, Suite G, Fairfield, CA 94534
tel: 707/864-5800; fax: 707/864-5879
EAST: PO Box 843, Culpeper, VA 22701
tel: 540/825-5700; fax: 540/825-5789
e-mail: karen@euromachinesusa.com
website: www.euromachinesusa.com

PLEASE SEE EURO-MACHINES AD, PAGE 40.

GF PIPING SYSTEMS

COOL-FIT® ABS Plus from GF Piping Systems is a complete, pre-insulated, plastic piping system for glycol and secondary cooling, designed to meet winery requirements. COOL-FIT is used to cool fermentation tanks, storage areas, heat exchangers, and air conditioning.

Fluid temperatures range from 21°F to 29°F, using glycol or salt solutions. COOL-FIT is the quickest-to-install secondary piping system in the world. Pre-insulation and fast-solvent cement joining mean an extension to an existing system can be built in just a few days with no need for specialized installers.

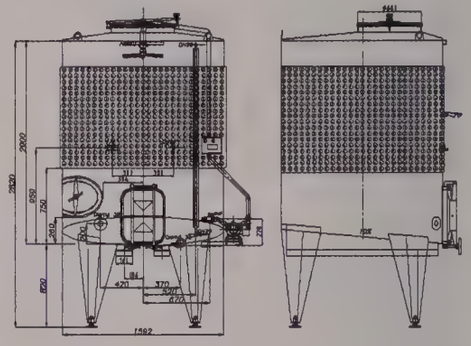
COOL-FIT ABS piping systems contain pipe, fittings, valves, and transition fittings, are UV resistant, vapor-tight, and 100% water-tight: no dripping, no mold, and very efficient. COOL-FIT can improve the efficiency of a secondary system by up to 40%. COOL-FIT is

manufactured from high-grade pressure-rated ABS, totally corrosion-free (externally and internally), requiring minimal maintenance. COOL-FIT is supported by the external jacket pipe – no expensive, inefficient insulated pipe supports needed. No energy bridges are created when hanging COOL-FIT pipe. COOL-FIT is designed for a lifespan of 25 years plus, and environmentally friendly; a TEWI report is available. Installation training is provided free of charge. COOL-FIT® comes with a full range of actuated valves, measurement, and instrumentation.

For more information, contact:
GF Piping Systems
2882 Dow Ave, Tustin, CA 92780
tel: 714/731-8800; toll-free: 800/854-4090
e-mail: us.ps@georgfischer.com
website: cool-fit.georgfischer.com

MIO VIGNETO PRODUCTS

Mio Vigneto Products was founded in 2005 to import high-quality, custom wine tanks, fermentors, and equipment for wine production. Mio Vigneto works closely with customers from concept to finished product, to ensure the tanks are designed to exact specifications. Jim Schultz, Windy Oaks Winery (Corralitos, CA) wrote, "Excellent quality at reasonable prices, with exceptional customer service built around an understanding of vintners' needs."



Mio Vigneto offers products made with old world craftsmanship using modern day technology:

Closed top tanks from 25 to 5,500 gallons,
Oval tanks from 135 to 1,500 gallons,
Rectangular tanks to 1,700 gallons,
Variable capacity tanks from 25 to 2,600 gallons,
Pump-over fermentors from 500 to 5,500 gallons,
Automatic pump-over and punch-down fermentors to 5,500 gallons,
Semi-automatic bottle fillers,
Stainless steel articulating bladder presses,
Standard and custom valves and adaptors,
Temperature controllers and gauges,
Ultra low pressure N_2 regulators,
Manual Stelvin capsule sealer,
Basket strainers,
Spray balls,
Decanters.

For more information, contact:
Mio Vigneto Products
130 Minerva Way, San Ramon, CA 94583
tel: (415) 531-6450
e-mail: dwightb@miovigneto.com
website: miovigneto.com

PLEASE SEE MIO VIGNETO PRODUCTS AD, PAGE 32.

PULSAIR SYSTEMS, INC.

Pulsair's innovative "Pneumatage" is a proven method of managing the cap on red wine during fermentation. The process and equipment is being used worldwide to replace pumpover, punchdown, irrigation, and other conventional methods of cap management, to produce high-quality, more drinkable wine at low cost.

Pneumatage automates the fermentation cycle, leaving the winemaker to test, examine, evaluate, and taste the wine during fermentation, and not worry about the daily chores of turnovers, labor management, and paperwork.

Pulsair™
SYSTEMS, INC.

The Pulsair TM and PTM all-pneumatic portable mixers allow small wineries to turn the cap from the top of the fermentor, or through the racking port. The Wine Cart expands the ability of the TM and PTM mixers to include mixing of large tanks, in a semi-automatic mode.

The fully-programmable Pneumatage system will turn multiple tanks on a pre-determined time schedule for 14 days. More than 100 tanks can be operated from one central controller. When fermentation is completed, any Pulsair system can be used to quickly mix and blend, to create a great Estate Vintage.

For more information, contact:
Pulsair Systems, Inc.
tel: 425/455-1263; toll free: 800/582-7797
e-mail: sales@pulsair.com
PLEASE SEE PULSAIR SYSTEMS AD, PAGE 9.

PRO REFRIGERATION INC.

Pro Refrigeration is a leading manufacturer and supplier of refrigeration equipment to the wine industry. Pro's mission is to build the highest quality, most efficient chiller systems for the markets they serve. Pro strives to not only provide a turnkey solution for the larger production wineries, but also be the best solution for wineries of all sizes.

ChilStar
CHILLER • SYSTEMS

Pro Refrigeration offers a new line of compact systems: The ChilStar™ Micro Chiller System is available in 2 HP, 3 HP, and 5 HP models. These systems can control up to five fermentation tanks of varying sizes and have the ability to operate at a 20°F chilled glycol temperature for cold settling and cold stabilizing duties. Pro Refrigeration offers this line as a solution for wineries working with limited production, and an affordable option that a large producer can utilize for individual tank control.

Pro is fortunate to have collaborated with some of the finest winemakers to develop and expand a product line specifically for the winemaking craft.

For more information, contact:
Pro Refrigeration Inc.
326 8th St. SW, Auburn, WA 98001
tel: 253/735-9466; toll-free: 800/845-7781
fax: 253/735-2631
e-mail: info@prorefrigeration.com
website: www.prochiller.com
PLEASE SEE PRO REFRIGERATION AD, PAGE 13.

TOM BEARD COMPANY

The Tom Beard Company (TBC) is producing a line of half-ton bin washing machines which were recently awarded a U.S. patent for design and function. The units feature water recycling, precision cleaning, and automated stacking. This series of washing machines are impeccably designed and engineered to the highest standards. Call now to reserve a model.

Also from TBC, the TBC2-ST is the safe and efficient way to steam barrels. The TBC2-ST is a stand-alone unit that delivers a measured amount of steam, automatically inserts a bung to establish a vacuum for an adjustable time period, removes the bung, and rinses the barrels with hot, cold, or ozone-charged water. Rinse water is contained for controlled disposal.

The TBC2-ST is loaded by forklift, and operates via programmable controller. There is no need for workers to be in the vicinity of the steam at any time. Available with or without steam generation.

TBC is focused on creating machinery that will stand the test of time, use the least amount of water, and generate a minimum of wastewater. For 2-barrel, 4-barrel, half-ton bin washing machines and cellar equipment, Tom Beard Company has it covered!

For more information, contact:
Tom Beard Company
1650 Almar Pkwy, Santa Rosa, CA 95403
tel: 707/573-3150; fax: 707/573-3140
e-mail: jmendoza@tombeard.com
website: www.tombeard.com
PLEASE SEE TOM BEARD CO. AD, PAGE 53.

OGLETREE'S, INC.

For more than 65 years, Ogletree's has specialized in the design, fabrication and installation of winemaking equipment. Products include hoists, receiving hoppers, belt and screw conveyors, sorting systems, bin dumpers, transfer lines, and aluminum catwalk systems, plus maintenance on all equipment offered.

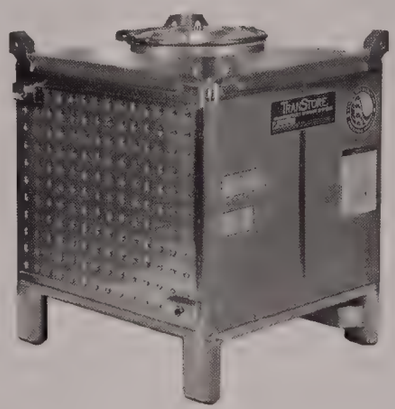
Ogletree's design team creates a superior product by collecting input from clients and focusing on specific needs. By utilizing quality-control procedures and inspections, coupled with a talented group of fabricators, Ogletree's team delivers products second-to-none.

Ogletree's has added a new grape receiving hopper designed to accept 2-ton valley bins, and greatly reduce damage to the fruit while maintaining an even out-feed. A 24-inch diameter auger with flight edging moves the fruit through the hopper. The output end of the hopper is completely open, allowing fruit to discharge onto an incline belt (without shearing) that meters fruit into a destemmer.

For more information, contact:
Ogletree's, Inc.
935 Vintage Ave., St. Helena, CA 94574
tel: 707/963-3537; fax: 707/963-8217
e-mail: samp@ogletreecorp.com
website: www.ogletreecorp.com
PLEASE SEE OGLETREE'S AD, PAGE 54.

CUSTOM METALCRAFT

CUSTOM METALCRAFT has provided quality tanks and equipment to the wine industry for almost 20 years. A family company that understands the challenges presented in the winemaking process, Custom Metalcraft can make the best recommendation for winery product needs.



Custom Metalcraft offers TranStore wine storage and fermentation tanks in a variety of standard or custom sizes, up to 3,000 gallons. Tanks may be used for storage, fermentation, or cold stabilization. Numerous options include jackets, sample valves, thermowells, side manways, and special interior finishes. Tanks can be stacked 3-high, and moved with a fork truck or pallet jack. Custom Metalcraft can custom fabricate according to winery specifications.

Custom Metalcraft has added 30-gallon and 60-gallon stainless barrels to its product line, made from 10 gauge 304 SS material, which can be stacked up to 6-high in all standard barrel racks.

Custom Metalcraft offers bin dumpers, heat exchangers, incline conveyors, receiving hoppers, horizontal and incline augers, and sorting tables. All equipment can be customized to fit winery applications.

For more information, contact:
Custom Metalcraft
PO Box 10587, Springfield, MO 65808-0587
tel: 417/862-0707; fax 417/864-7575
e-mail: cmcsales@custom-metalcraft.com
website: www. custom-metalcraft.com
PLEASE SEE CUSTOM METALCRAFT AD, PAGE 38.

VALLEY PIPE & SUPPLY, INC.

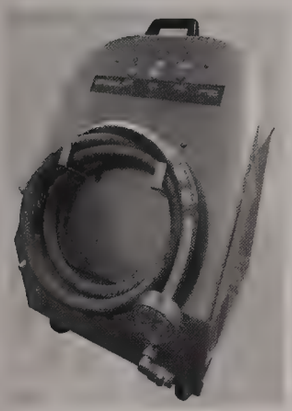
Valley Pipe & Supply has been supplying highest quality crushpad equipment to the wine industry in the U.S., Canada, and Mexico for the past 25 years, manufactured by such names as Defranceschi/Amos, Spadoni, Milani, and the Valley Pipe & Supply brand. For small, medium or large wineries, the full line of crushpad machines, automated punch-down fermentors, filters, pumps and miscellaneous supplies comprise everything needed for each harvest.

Valley Pipe & Supply introduces the new Protec X-Tri optical sorting machine with state-of-the-art 3-camera design. The X-tri has been working in several European wineries and the first U.S. winery installation in Napa, proving itself very easy to clean and with excellent sorting results. The X-Tri comes in three capacities: 5 tph, 10 tph, and 15 tph.

Call the top-quality sales and support staff at Valley Pipe & Supply to discuss the new optical sorter, and the full line of equipment and supplies.

For more information, contact:
Valley Pipe & Supply, Inc.
Mitch Long, President: 559/233-0321
Stuart Smith: 559/233-0321
Leng Widjaja: 559/233-0321
Conrad Weathersby (Tech Support):
559/233-0321; cell: 559/281-5498
Michael Haswell (Napa): 707/293-6720
Gary Hanson (Oregon): 541/678-1550
David Meneses (Mexico): +6373727382
PLEASE SEE VALLEY PIPE & SUPPLY AD, PAGE 35.

SPEC TRELLISING



The VaporONE electric-powered steam system will clean and sanitize bottling lines, filter systems, filling machines, and barrels, and disinfect SS tanks. Steam penetrates the micro-filters and pores of piping surfaces for complete sanitizing.

Cella-Stac is a palletized, modular system for safely storing bottled wine, comprised of layers of thermo-formed, food-grade plastic sheets. Cella-Stac 48CS accommodates 48 bottles per layer, and Cella-Stac 40CS accommodates 40 bottles per layer, up to 14 layers high. Both sizes work with most bottle types.

New in 2013, SPEC is offering Albrigi tanks. For more than 30 years, Albrigi has been manufacturing stainless steel tanks from mirror-polished AISI 304L and 316L BA stainless steel, sourced from Thussen Krupp, and specifically designed to be used for wine production.

Tops and bottoms of the tanks are joined to the tank wall using "rounded" corners to eliminate hard-to-clean 90-degree joints.

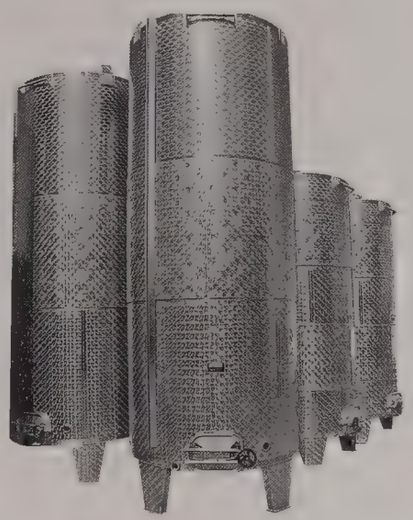
All Albrigi tanks can be cleaned effortlessly with steam or hot water, without the use of dangerous caustic cleaning agents. It is NEVER necessary to enter an Albrigi tank to clean it. Tanks are pressure-tested AND hydro-tested before shipping to check for structural integrity. Albrigi tanks come with an "Original Food Services" certificate. Stefano Albrigi is so confident of his tanks, he guarantees them for 25 years.

For more information, contact:
Spec Trellising
39 Indian Drive, Ivyland, PA 18974
tel: 800/237-4594; 215/322-5588
fax: 215/357-3122
e-mail: info@spectrellising.com
website: www.spectrellising.com

PLEASE SEE SPEC TRELLISING AD, PAGE 54.

RAYNOX 2000, INC.

Recent modernization of the manufacturing plant allows Raynox to offer the best quality ever with refined design. Raynox off-the-line standard tank models set an industry benchmark for red and white fermentation and storage tanks.



From well-designed standard models, to carefully crafted custom tanks and on-site fabrication, Raynox has assisted North American wineries of all sizes, ensuring quality and craftsmanship meeting high standards. Custom fabrication expertise ensures Raynox can meet winemakers' exact needs.

Raynox repeat customers especially value the post-sales service.

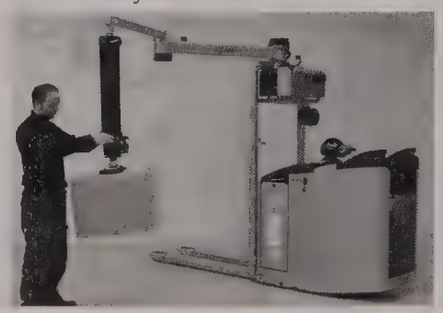
Raynox offers winemaking equipment selected with the same care used to manufacture tanks. From the sorting table to bottle labelling, Raynox has equipment to help winemakers every step of the way.

For more information, contact:
Raynox 2000 Inc.
Sales Department
1148 St. Michel Street, St-Césaire
Quebec, Canada J0L 1T0
tel: 866/469-4181 (toll free); fax: 450/469-2112
e-mail: info@raynoxinc.com
website: www.raynoxinc.com

PLEASE SEE RAYNOX AD, PAGE 57.

AMERICAN CRANE & EQUIPMENT

American Crane & Equipment Corporation, a manufacturer of overhead electric cranes and hoists, offers a cargo-lift, detachable, vacuum system, and free standing vacuum lifters (AL-VAC systems) that are ideal for the wine industry.



Vacuum lifters and manipulators are utilized to lift objects weighing a few pounds to several tons. Their smooth action makes them easy to operate, increasing efficiency and reducing the labor costs associated with production, lead, and delivery time. In addition, a wide variety of accessories and end-effectors are available, including those specifically designed for the beer, wine, and beverage industries.

The vacuum lifter be can be free-standing or attached to a forklift truck and reduces the time spent loading kegs, barrels, and drums to a pallet while ensuring the safety of the operator and load. A variety of vacuum pads and attachments are available, including the Keg Lifter, for specific applications. Using vacuum power can considerably reduce the number of injuries suffered on the job.

From complex, custom, overhead lifting equipment to standard equipment, components, and parts, American Crane can meet all material handling needs, large or small. For more information on AL-VAC products visit online or call.

For more information, contact:
American Crane & Equipment
Thomas Benfield
tel: 877/503-2972 ext. 158
e-mail: tbenfield@americancrane.com
website: americancrane.com/al-vac

St. Patrick's Of Texas

St. Patrick's supplies equipment for small to mid-size wineries from three warehouses (35,000 square feet) in Austin, TX. Product descriptions and pricing are available online at www.stpats.com. Equipment manuals are also available online.

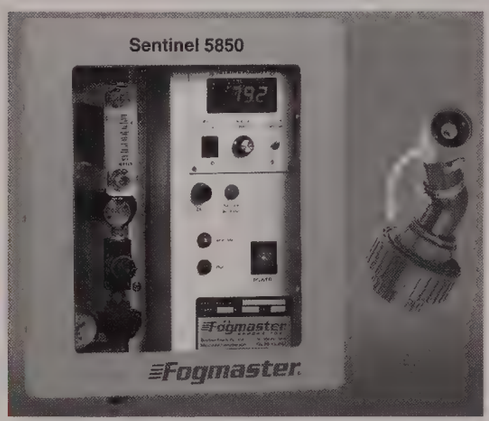
St. Patrick's of Texas stocks the following equipment:

- Revello peristaltic pumps,
- NIKO pneumatic membrane presses,
- MEP semi-automatic corkers,
- MEP semi-automatic labelers,
- Letina wine tanks,
- EnoItalia crusher/destemmers,
- Sanitary valves and fittings,
- Filling machines,
- Plate and frame filters,
- Membrane filters,
- Wine and must pumps,
- Heat-shrink and foil applicators.

For more information, contact:
St. Patrick's of Texas
1828 Fleischer Dr., Austin, TX 78728
tel: 512/989-9727; fax: 512/989-8982
e-mail: stpats@stpats.com
website: www.stpats.com
PLEASE SEE ST. PATRICK'S AD, PAGE 77.

Fogmaster Corporation

Fogmaster's Sentinel-5850 barrel-room humidification system brings innovative atomization technology to small- and mid-size wineries. It uses a turbulent-vortex nozzle to atomize water into micro-droplets that evaporate quickly and spread uniformly throughout the barrel room.



The control unit (see photo) monitors relative humidity and regulates water flow. A regenerative blower, designed for efficiency and low-maintenance cost, provides air to atomize water.

When humidity drops below the set point, the control unit activates the system and the nozzle ejects a fog of tiny droplets. The droplets evaporate quickly and raise humidity so barrels stay dry. Because the nozzle has no tiny orifices, nozzle plugging is not an issue.

Designed for "do-it-yourself" installation, the Sentinel-5850 includes all installation components except two-inch PVC pipe from the blower to the nozzle.

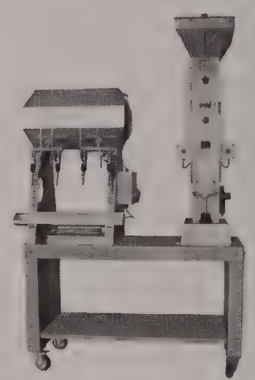
A single nozzle system can maintain humidity in barrel rooms of 1,000 to 5,000 square feet. A cart option is available for users who want to move the humidification system from room to room.

For more information, contact:
Fogmaster Corporation
1051 SW 30th Ave., Deerfield Beach, FL 33442
tel: 954/481-9975; fax: 954/480-8563
e-mail: info@fogmaster.com
website: www.fogmaster.com
PLEASE SEE FOGMASTER CORP. AD, PAGE 50.

Napa Fermentation Supplies

Napa Fermentation Supplies offers a full line of winemaking equipment and supplies, including variable capacity stainless steel tanks with adjustable lids from 26 gallons to 2,693 gallons and closed-top tanks from 79 gallons to 5,221 gallons, with or without manway, and with or without cooling jackets.

Also available are: Karcher hot water pressure washers with 1,300 psi to 3,000 psi and temperatures from 86°F to 285°F steam; one-inch and 1.5-inch Jabsco pumps with AC inverter drive; 2-inch or 3-inch Zambelli must pumps with AC inverter drive; Zambelli crusher/destemmers from two to 14 tons per hour; Zambelli manual and hydraulic, membrane, and bladder presses; 8-inch and 16-inch Zambelli plate filters; Tivoli corking/filling machine with 4-spout filler and jaws for synthetic or natural corks; a full line of stainless steel fittings and valves, butterfly and ball; one-inch to 4-inch wine hose; labware; refractometers; wine thieves; and table-top labelers.



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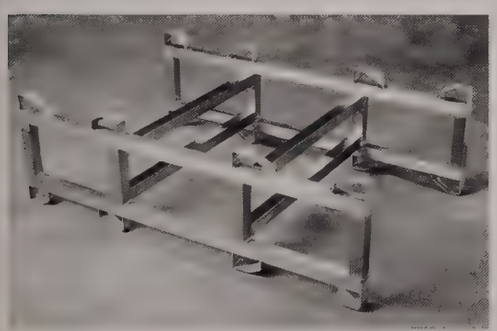

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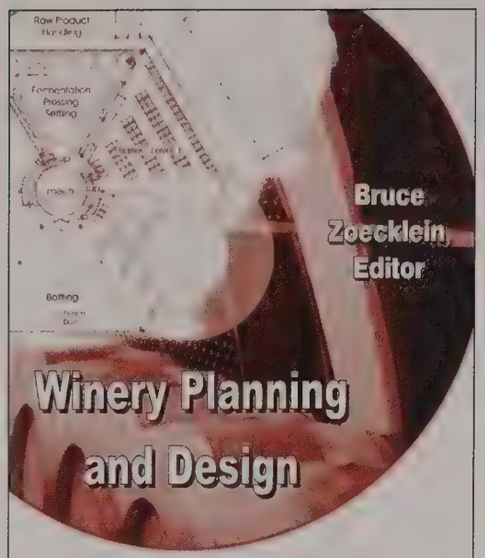

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Proficiency testing for wine analysis — so you can be sure...

BY Sue Caloghiris

Participation in a proficiency testing program can be a very powerful quality tool in any well-run laboratory. Below we will discuss a program that will provide both the winemaker and the technician with peace of mind.

What is proficiency testing?

Proficiency testing is the analysis of samples in conjunction with other laboratories testing the same or similar sample types. The process usually involves analysis of the sample for particular compounds, followed by collation and statistical analysis of the results. Proficiency testing allows you to compare your laboratory's analytical results with those of other laboratories who have analysed the same samples at the same time.

What is available to wine industry laboratories?

There are many programs available to the wine industry. Most offer analysis in a range of beverages that include wine and usually offer a limited list of compounds for testing. Others target things like agrochemical residues and are only valuable to those laboratories that have the facilities to test such things. There is one program, however, that is wine-specific and is run by wine industry people for the wine industry.

Interwinery ANALYSIS GROUP

Interwinery Analysis Group

The Interwinery Group is an Australian group that commenced formally in 1983 after almost 20 years of informal operations. The group is run by a committee of laboratory staff from wineries in many wine regions of Australia and has almost 250 members, including several from wine regions in the U.S., France, South Africa, and New Zealand. This program offers an opportunity to perform 17 analyses. These are:

- Free SO_2
- Total SO_2
- pH
- Titratable acidity
- Volatile acidity
- Malic acid
- Alcoholic strength
- Residual sugar
- Specific gravity
- Citric acid
- Potassium
- Copper
- Iron
- Sodium
- Calcium
- Carbon dioxide
- Turbidity

Note that the ability to analyse all these parameters is **not** required — in fact some members submit results for only two or three analytes.

How does this program work?

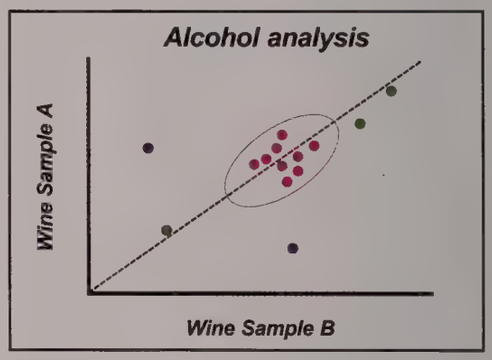
Each participating laboratory receives one case of samples per year. The wine samples are labelled in pairs marked YY-01-06 A and B, where YY is the year, 01 is the round number and A and B are the sample pair (i.e. the samples for this month's round would be labelled 13-01 A and 13-01 B).

Analysis is performed by all participating laboratories during the same 7-day period and the results are entered via a portal on the Group's website. The results are then collated and run through a powerful statistical program, which allows complex statistical processes to be interpreted in very simple graphic analysis. This gives the participating laboratories clear information about the quality of their results.

Each analysis is graphed in a similar fashion to the one shown below. The A and B results for each sample are plotted one against the other on the x and y axis. Each pair of results forms a dot on the graph that lies within a certain area.

The statistical information also includes a calculation of the mean or average of all the results. This mean is used to calculate the 95% confidence interval or the ellipse that surrounds the accurate results.

The aim of participation is to get all your laboratory results within this 95% "ring" of confidence (where the red dots lie). The more participants in the program, the tighter this confidence interval should be. The results are also provided in numeric form so that simple comparison to the mean and the average can also be performed.



This graph demonstrates the different areas where results might lie, and their interpretation. A result falling within the circle is ideal, while results falling on the 45 degree line, but not within the circle, indicate a systematic or bias error. Results that fall neither on the 45 degree line nor within the circle are usually random in nature.

Ideal — A result in this area means that you have submitted a result that lies within the 95% confidence circle (or ellipse in this case) for that analysis. This means that

your result is very close to the mean result for the whole group.

- **Random errors —** A random error often indicates human error, as one result is usually correct and the other erroneous. This could be due to sample preparation error or some sort of oversight during the analysis (not adding a critical reagent). It is usually difficult to determine what happened after the event and is therefore important to have systems in place that prevent it from happening in the first place.

- **Systematic or bias errors —** A systematic error indicates that the errors have occurred across multiple analyses and are likely to be errors somewhere in the "system." These errors are the most dangerous because analysis of a duplicate sample will give the same result leading to a sense of false security.

Standards, and more importantly spikes, are useful in determining the source of these problems, which are usually based on errors involving reagents, equipment, method, or training. Spikes are a more useful tool in this instance because sometimes the problem is matrix-related and analysis of an aqueous standard solution will not always isolate the problem.

How do we determine where our results are on the graph?

In order to determine where your result lies in comparison to others, review the data with your submitted results in hand. By using the grid on the graph with your results you can easily determine which dot you are — whether it is in the red, blue, or green region.

(Please note that on the true graphs, the dots are all black. Colors were used in this case to demonstrate and provide interpretative information about the different areas of the graph).

Evaluation of these graphs and the position of your laboratory on them is critical in proficiency testing. Alternatively, you can compare your results to the numeric results also provided.

To neglect this task is like failing to get your results after sitting an exam or having a blood test! The second most important task is to review those analyses that did not provide "good" results and attempt to determine where any deficiencies might lie. A review of the method, some additional standards, duplicates or spikes, and inspection of the equipment and method would be some areas to look at. The group also offers corrective action samples so that you can repeat the analysis after determining and fixing the problem.

Disadvantages of this type of proficiency testing program

While this statistical analysis provides comparative information about the results, it does not provide any

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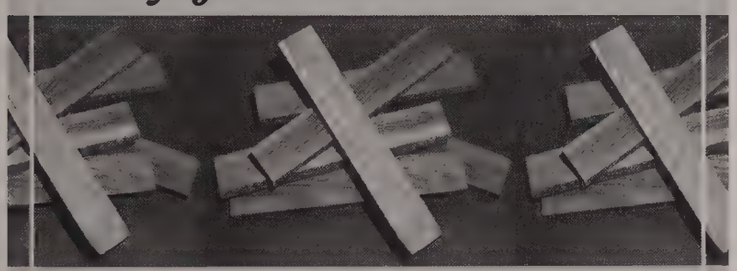

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information about the absolute accuracy of any one result. Proficiency testing based on accuracy depends on two assumptions.

The first is that one particular laboratory will be accurate in its analysis every time and is therefore classed as a reference laboratory. Some laboratories are more likely to be accurate, such as those with quality accreditation and sophisticated equipment. However, while there are humans involved in the process, there will always be a risk of error.

The second assumption is that the samples submitted to every participant are homogenous. To make sure that this indeed occurs, exhaustive homogeneity testing is performed. The Interwinery Analysis Group has recently achieved ISO guide 17043 Proficiency Testing accreditation.

Samples are taken ex-bottling line and, for the most part, experience few problems with bottle variation. The statistical analysis is somewhat dependent on the sample size; therefore the more participants, the more useful the results.

How much does it cost to participate?

Membership in the Interwinery Analysis Group costs AUD$350 per year for six rounds. This fee includes samples, results, access to a troubleshooting forum and seminar presentations, and free seminar attendance to two seminars per year. However these membership fees do not include freight to overseas destinations. The 2013 fees for shipping to the U.S. are AUD$350, bringing the total cost to AUD$700 or just over AUD$100 per round.

Now that you have learned about proficiency testing programs, you need to take advantage of this wonderful support mechanism for wine industry laboratories.

The program offers complete confidentiality of individual laboratory results, while at the same time providing a network of contacts within the industry that can be a valuable resource should you have a problem. Most often, if you have identified a problem with one of your analyses, you can be sure that several other wineries have experienced the same problem at some time.

If you join before end of January 2013, you will be able to participate in five of the six yearly rounds and will also be able to check your current analysis against the results available for round one! ■

Sue Caloghiris (formerly Sue Weeks wrote 16 Winery Laboratory Quality columns in **PWV** *2000/2001/2002) has been active in the Australian wine industry for more than 25 years including 14 years at The Australian Wine Research Institute. She now runs Bibber International which offers several services to the wine industry world-wide and is secretariat of the Interwinery Analysis Group. She is CoAuthor of* Chemical Analysis of Grapes and Wine: Techniques and Concepts. *For more information, please visit www.interwinery.com.*

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New method to determine optimal ripeness for white wine styles

BY **Professor Alain Deloire**
Department of Viticulture and Oenology, Stellenbosch University, South Africa

Optimal grape maturity criteria is multi-faceted. Several important classes of compounds are biosynthesized during the berry growth period, before and/or after véraison (aromatic precursors, phenolics, hormones, organic acids, etc.), while others are provided by roots and/or leaves (water, minerals, sugar, etc.). Several of these compounds change during the ripening stage of the grape berry.

These changes do not occur in a highly coordinated fashion, and, instead, suggest a series of independently regulated pathways of synthesis. These pathways differ between cultivars and are also influenced by seasonal climatic factors and vineyard practices. To add to this complexity, each berry within a bunch has its own dynamic of growth and maturation.

The question therefore can be raised as to how to explain and manage this complexity at both the scientific and practical levels? There are several methods already used by viticulturists and winemakers to choose an appropriate harvest date. All of these methods are highly relevant when put in the context of a winery's strategy. The different methods are:

A. harvest according to previous knowledge of a specific cultivar and vineyard, without any analysis but through visual observations, building up personal experience as a producer (or a traditional grower);

B. harvest according to one criteria that requires simple, routine analysis, such as Brix (the most commonly used indicator in the wine industry today);

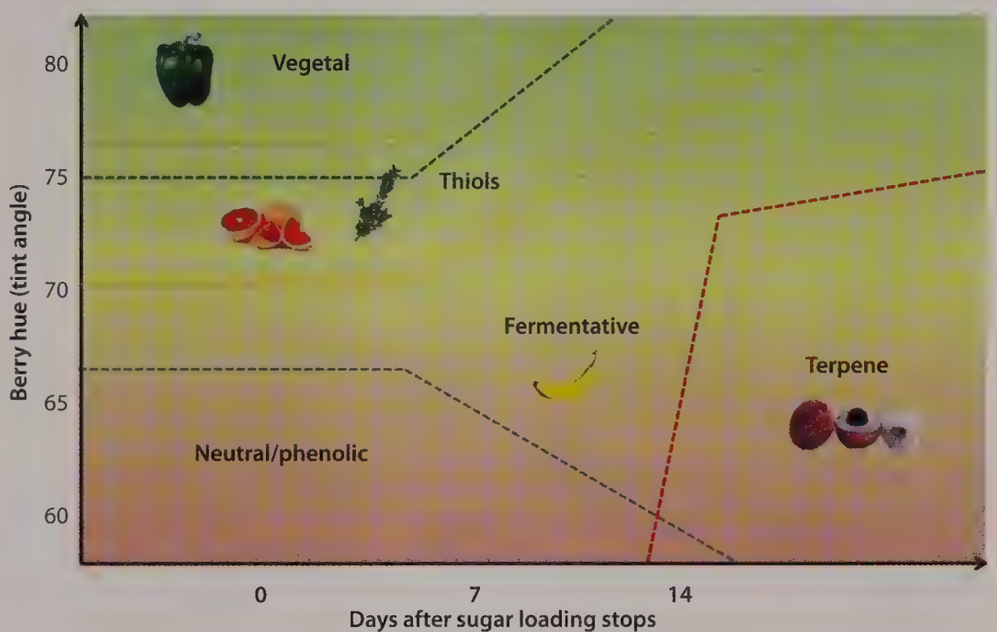

Figure 2: White cultivars berry aromatic model (from Vivelys, France). The method uses the berry color evolution from véraison to harvest (berry hue or tint angle in degree: y-axis) and the berry sugar loading concept (x-axis). According to the evolution of the berry hue, the method allows to predict the wine style (see Table I). The Sauvignon Blanc berry aromatic model for the Western Cape region is under development and calibration by Distell group within a collaboration with the Department of Viticulture & Oenology (Stellenbosch University).

C. harvest according to berry tasting, which can be efficient but is also very subjective; the decision depends on the personal experience and training of the taster;

D. harvest using a series of indicators and appropriate analysis methods. This implies that the necessary apparatus is available at the estate, or in an appropriate nearby laboratory. Knowledge in interpreting analytical results to take the appropriate action is required. The cost per acre has to be considered;

E. harvest using new tools and taking into consideration new scientific findings. This implies the ability to access the information, understand, assimilate it, and implement it successfully. In addition, the ability to afford this new technology, which may be expensive, has to be considered.

This list is not complete. When scientific indicators are used to determine harvest date, it is important that appropriate skills and information be transferred to the people who are using them. For example, such skills include being able to interpret analytical data, using analytical tools properly with a standard protocol, and sampling correctly. The important question of transfer, which has many facets, will not be discussed in this article but is an aspect which needs to be addressed.

Optimal grape ripeness

Optimal grape ripeness is defined according to the style of wine required, which in turn is dictated by market demand or by the objective to produce a wine that respects the expression of a typical terroir-related character. Professionals working within the sector are therefore obliged to accurately char-

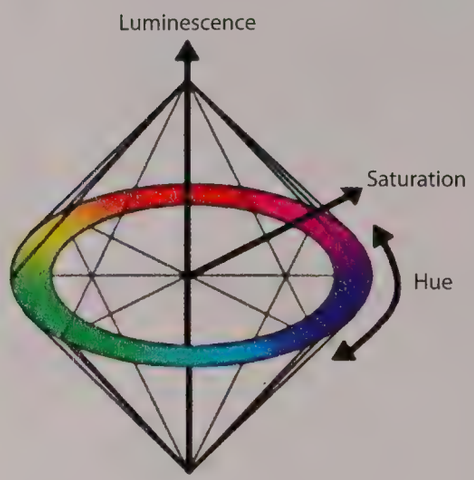

Figure 1: The Hue, Saturation, and Luminescence (HSL) model of color representation which gives hue values in degree from 0 to 360°.

acterize the grapes in order to make an informed decision to optimize the harvest date and adapt fermentation practices to obtain a target wine style. This characterization also provides important information on vine growth patterns.

One of the most important and difficult parts of a viticulturist and winemaker's job is to predict wine style from the berries and the enological process. Classical indicators like Brix, malic and tartaric acids, titratable acidity, tannins, anthocyanins, etc. are strongly related to the perception of the taste of the wine. It would also be very useful to be able to predict or predetermine the future wine style in terms of aroma. This is one reason why the question of fruit maturity and optimal ripeness is still a relevant subject in the scientific community and the wine industry.

Grape quality is a crucial determining factor in the quality of the finished wine, and is fundamentally linked to optimum ripeness. But how is grape quality determined? What are the relevant parameters of the berry that enable the dynamics of ripening to be monitored?

Grape quality – a complex and relative concept

Grape quality is not a simple concept,[11] that depends on several vineyard parameters and on the wine style goal. A classic example is Chardonnay grapes produced for making Champagne and Burgundy respectively. The ideal ripening conditions of this variety will not be the same for production of these two quite different wines.

In other words, a specific wine style demands a particular set of ripening conditions,[5,16] and the concept of grape quality at harvest should be considered in terms of the required wine composition and sensorial properties – in short, what grape quality for which type or style of wine? Particularly, what is meant by grape berry quality?

Apart from the hygienic quality that depends on grape bio-aggressors (fungi such as *Botrytis cinerea*, yeast such as *Brettanomyces*, insects etc.), a

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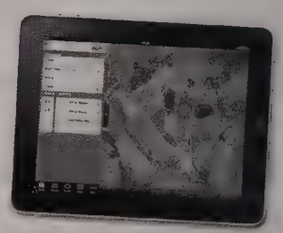
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Table I: Thresholds of berry hue (degrees F) according to the HSL model of color representation and expected style of wine for Sauvignon Blanc (*Vitis vinifera* L.).*

Berry hue thresholds degree related to angle (0 to 360)	Expected wine aromatic profiles
> 90	green/unripe
90 - 85	green/asparagus
85 - 80	asparagus/citrus
80 - 75	asparagus/tropical fruit/ grapefruit/citrus
75 - 70	tropical fruit
70 - 65	fermentative/terpene
65 - 60	phenolic/neutral/terpene

*In some specific climatic conditions, the thresholds need to be adjusted. The thresholds calibration is done by establishing a relationship between the berry hue angle and the wine style (wine tasting and/or sensorial analysis).

discussion of the grape berry profile in terms of harvest potential would be more pertinent than the quality of the grape berry itself which is a far more ambiguous concept.

Grape berry profile is a combination of different biochemical parameters of the fruit, associated with other factors, such as berry skin color development for white cultivars, extractability during fermentation and fruit compartmentalization. Harvest potential describes the potentiality of a vineyard block in terms of grape profile, whereas typicality is the reproduction of a given grape profile based on its conformity to a specific type in an identified terroir.

The aim of this paper is to describe and propose the use of a recent indicator to monitor ripening of white cultivars in relation with the desired wine style (for red cultivars see Deloire, 2011).[8]

A new indicator should be used in conjunction with other classical indicators of berry ripening. Berry color development and the associated reasoning for the method will be presented below as a relevant new indicator.

Berry color development for white cultivars

Berry color is a new and important indicator, notably of the ripening of white varieties, because a proven relationship exists between berry color and their aromatic potential. Carotenoids, phyto-protective pigments produced by photosynthesis, are localized in the skin and are considered as biogenetic precursors of C_{13}-norisoprenoid glycosides. Certain aromas are derived from the degradation of such skin pigments.[12,13,14,15,17,18,19,20,22,23,24]

The technology to measure berry skin color has been developed by Vivelys Society (France) in partnership with Montpellier SupAgro (France) and is currently being used in the Northern and Southern Hemisphere. The method uses the development of the berry tint angle (berry color evolution), which is determined using optical technologies, as an indicator of berry ripening versus wine aromatic profile.[10] This method is based on an indirect relationship between the evolution of the berry tint angle (according to the HSL model – Hue, Saturation, Luminescence; Figure 1) and the wine sensorial analysis (Figure 2), and as can be seen, has potential to be very useful for profiling berry maturation, harvest potential, and selection of the most appropriate harvest dates for white cultivars.

In addition, measurements can be taken with relative ease and, in a short time, should the instrumentation be available. This technology is currently being refined and used for the wine regions of the Western Cape coastal area of South Africa, within a collaboration with Distell group and Winetech financial support.[9] Table I shows examples of berry hue thresholds and related style of wine for Sauvignon Blanc in the Western Cape region.

The first results of research conducted in South Africa in 2009 show different rates of berry color evolution, from green to yellow, which seem to be mainly related to temperature (meso- and micro-climatic

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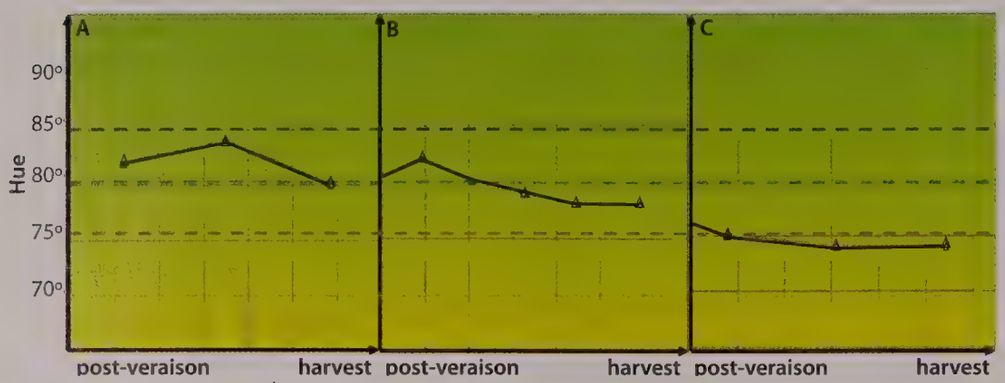

Figure 3 (A, B, C): Examples of Sauvignon Blanc berry color evolution during the ripening period. These examples give an indication of possible styles of wine, within the context of three different macro, meso, and microclimates. A) The wine related to this berry hue threshold (85 – 80) was described with an asparagus/citrus aromatic profile. This wine profile could be found in the Elgin region, mainly from shaded bunches. B) The wine related to this berry hue threshold (80 – 75) was described with a asparagus/tropical fruit/citrus aromatic profile. This wine profile could be found in regions as Stellenbosch (vineyard under sea breeze influence) or Elgin from a vineyard with exposed bunches and under sea breeze influence. C) The wine related to this berry hue threshold (75 – 70) was described with a tropical fruit aromatic profile, meaning a more one-dimension aromatic profile. This wine profile could be found in a warm region, even from shaded bunches.

levels) and light at the bunch level (micro-climatic level). The wine style (tropical/citrus/grapefruit or green/herbaceous/asparagus characteristics) is mainly related to the climate of a specific region (hot or warm versus cool). For the Western Cape area, a cool area is characterized by fresh nights during the ripening period (fresh night index,[21] and by the sea breeze effect,[1,2,3,4,6] which cool down the berry temperature during the ripening period.[7] No direct relationship has yet been established between berry color development from veraison to harvest, and Brix and titrable acidity. Although berry color monitoring will give a far better understanding of berry aromatic sequence evolution during ripening, it is therefore still recommended that at least two of the other classical indicators are used to monitor sugar and acidity in order to achieve the correct wine style.

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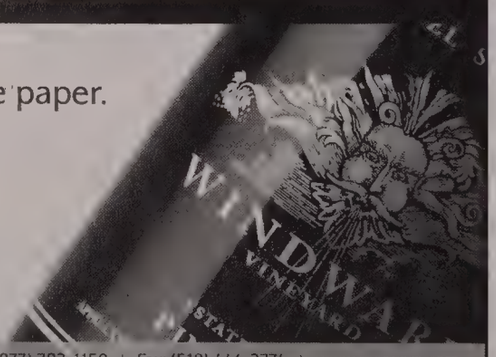

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2012 WINE INDUSTRY CEO SURVEY

Renewed optimism despite grape/labor shortages

BY **Robert Smiley, PhD,** Director of Wine Studies, Dean and Professor of Management, Emeritus, Graduate School of Management,
Gabriel Froymovich, Graduate Research Assistant, University of California Davis, Davis, CA

Despite a significant long-term shortage of grapes and economic pressures that are putting the squeeze on profit margins, California wine industry leaders are cautiously optimistic about the future, according to two new surveys conducted by the University of California, Davis. The surveys of wine executives and winemakers were presented during the Wine Industry Financial Symposium in Napa, CA (September 25, 2012).

"Industry leaders agree that while the somewhat giddy wine-buying days of 2006 and 2007 are not likely to return in the near future, there remains a strong and growing consumer base for California wines," says Robert Smiley. "These consumers are savvy, value-conscious wine drinkers who have weathered the economic downturn and perhaps have 'reset' their wine preferences at lower prices. Industry executives realize that they are going to have to earn their business by offering affordable quality and customer service."

Survey of wine executives

Smiley's 11th annual survey of wine executives collected opinions and projections from the heads of 24 leading wine operations. Many respondents represent wine companies; others are from operations that include grape-growing, wine-distribution firms, and financial institutions. The 2012 harvest of California wine grapes appeared to be strong, but it will not make up for several years of shortfall, Smiley noted.

Many survey participants are dealing with a grape shortage resulting from a growth in demand for wine that has not been matched by establishment of new vineyards or replanting of ageing vines. As a result, wine producers are paying higher prices for grapes, establishing or extending contracts with grape growers, and buying wine from other countries. They also are using grapes from broader appellations – buying fruit from vineyards beyond the most premium areas for specific winegrape varieties. And they are planting new vineyards.

As winegrape prices and other operating costs increase, wine producers are being hit from the other side by wine prices that remain stagnant. To survive this economic squeeze, they are boosting wine prices when the market will bear an increase, reducing operating costs, fine-tuning operating efficiencies, and strengthening their relationships with winegrape growers.

According to Smiley's survey, many industry leaders are hopeful that, as the economy gradually recovers, consumers will return to buying higher-priced wines, although probably not at the level of "conspicuous consumption" that marked wine sales in 2006 and 2007.

Furthermore, many of the wine executives said their firms are struggling with a shortage of vineyard laborers, noting that there are fewer people in the farm labor pool. When harvest of other crops in the region overlaps with harvest of winegrapes, growers often find themselves scrambling for field workers. To deal with the labor shortage, many survey respondents are increasing wages and benefits to attract employees, using labor contractors, and increasing their use of mechanization for harvesting.

Q: *Are you experiencing grape shortages? What are you doing to alleviate the impact?*

- We are starting to plant, about 300 acres of Cabernet in 2013. We planted some smaller quantities in 2012 (about 50-75 acres), and for the next two or three years we will plant just under 1,000 acres.
- We have channel-shifted away from retail to ensure that our on-premise restaurant accounts have on-going allocation supply. We have also adjusted price. We are a large landholder, so the one thing we have looked at in 2012 is the properties we have that are plantable. We planted 750 acres in 2012.
- We are going to withdraw from Pinot Noir in the national market and just sell it direct, because we cannot find a reliable Pinot Noir source or a Russian River appellation that we can price appropriately for our brand. We will diversify to larger appellations in some situations – say from a Sonoma County Sauvignon Blanc to a North Coast Sauvignon Blanc.
- Yes, we have definitely felt the impact of grape shortages and have tightened up our release dates. We really believe in the continuous improvement approach to the business. We have made minor changes to our blend profile, and evaluated and included offshore supply to ensure inventory.
- The big three, Gallo, Constellation, and the Wine Group, now can satisfy what we will call the "under $6 wine category." They have really gone off-shore. For the first five months of 2012, bulk imports have more than doubled. If it keeps the current pace, it will be equivalent to importing around 175,000 tons of additional volume more than 2011. To me that is a staggering number. A 3.5 million-ton crush is a significant amount.
- We have a fairly well-established set of long-term grape contracts that have shielded us from short-term grape pricing fluctuations. We have gone offshore. For example, no one

predicted the popularity of Moscato, and California cannot really supply the demand, and certainly cannot supply it at a price that makes sense to sell at $5 or $6/bottle. We contract some of our supply from off-shore to mitigate the cost increases. But if demand exceeds the offshore supply, then you have to go into the California market to buy the wine, and that hurts margins.

- The biggest impact that we have seen with this grape shortage is wineries buying grapes earlier in the season so they are not waiting until summertime, both on bulk wines and on grapes. Decision-making happens in a much quicker time-frame.
- We certainly are. We got in early and secured more grapes than we would have if it were just a normal year for us, so we consider ourselves very lucky. However, we want to grow not just this year and next year, but several years thereafter. The impact for us will be felt in a couple years, not right away, but you have commitments and contracts. You can see that you will spend more for those grapes than one year ago.
- Yes, we are experiencing grape shortages, specifically in Cabernet. I have seen many people taking price on it. We scrambled around. Basically we traded margin. We came up on the price, trying to meet our demand but we were able to fulfill our needs in 2012.
- Growers have seen the opportunity to increase price. The tide has shifted for them; so in many cases they are just waiting to maximize any profit opportunity in the short-term. Ideally, we are trying to build long-term relationships. We are trying to prevail upon our key growers that we are in it for the long-haul and we are good partners.
- We had to raise our prices; we took a price increase in January and February of 2012. We had to open up our sourcing; in some cases, we have gone to the California appellation to come up with the supply that we need. The bulk market has just been insane in terms of pricing; it shot up to $30 per gallon for Pinot Noir in 2012. In Napa in 2012, the starting price for Cabernet reached $35 – $40 per gallon – just totally insane. The good news is 2012 yielded a pretty good-size crop.
- I am not seeing any true grape shortages; the grapes are available if you are willing to pay for them and you are willing to seek them out. There is continued margin pressure on certain varieties and certain appellations, but we have found you can obtain the grapes you need. In terms of strategies, maximizing whatever blending flexibility the variety/appellation labeling laws give you is one. The most important is we have hired and trained a very dedicated grape procurement team to get to know the growers, know what is going on, understand the good and bad deals; just putting human resources into finding the grapes we need seems to be working.
- We are not. We contract 100% of our grape supply every year, and we anticipated the shortfall coming. We knew that there were not any grapevines being planted. 2012 was a normal-size grape crop in Sonoma County and Napa; we are in good shape.
- I am not sure if there is a grape shortage (all of my comments reference Napa Valley). They are saying that plantings are at a historic low, while wineries want to refill their inventories. This is a reaction to two short crops, rather than a grape shortage. A normal to slightly above normal harvest will be a game-changer very quickly.

GRAPE SHORTAGES SUMMARY

Most respondents are observing grape shortages. Strategies to secure grapes include:

- Paying higher prices for grapes;
- Establishing and/or extending grape contracts with growers;
- Sourcing grapes from offshore and/or utilizing a broader appellation;
- Planting new vineyards.

Q: *Are you experiencing margin compression due to rising grape prices and stagnant wine prices? What are you doing about it?*

- Wineries are taking price increases where necessary. They have to manage their businesses the best they can and if they have to take price increases, they have to. They have to consider, if they take a price increase what will that do to the brand? I know people taking price increases, and they expect a little flattening out, and they hope that the consumer will stay with them. Other people realize that if they take a price increase and their shelf-price goes up, it may cause them some loss in volume but if you have to do it, you have to do it.
- No question, there is downward price pressure, although I will say that for the round of price increases that we took in January and February, I had the least resistance from distributors that I can remember in 30-some years.
- In 2011, we raised our bottle prices in the $7 to $10/bottle tier. In 2012, we will have to see. It could affect the exports in 2012.
- We took our prices up about $0.50/bottle between January and June (2012). Is that easy to do? No, it never is. Everyone tells you your sales are going to fall off the face of the earth. But our Cabernet sales went up 5% over 2011. Chardonnay is a little more competi-

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tive. We have been able to pass it along on everything except Chardonnay.

• We have not taken a price increase in close to 10 years. But during 2008 and 2009 when everybody was discounting, we held our prices. I would imagine that, in the next couple of years, we are going to have to raise prices due to the grape market, inflation, and the cost of doing business.

"The wine business is a business of discovery and exploration; it represents an aspirational lifestyle. As the wealth-effect starts to present itself again, people will again become more aspirational in their purchasing habits and in wanting to get back to discovery."

• The ability to pass on cost increases is very brand-specific, depending upon your relative strength in the marketplace with your consumer base. It is a little different than the more commercial categories where, in addition to consumers, the trade has a lot of influence on the ability to increase prices.

• We are doing different things at different price points. We are taking prices up on everything above $20. We are taking price increases from $6 to $25 per bottle on our luxury wines. We are looking to lower the costs of other production goods to mitigate the increase in grape costs. You look at label size, standardizing bottles, and lightweight glass. There is a variety of different levers that you can pull and address to mitigate, but not offset, cost increases.

• Because we are going to a wider appellation and lower price-brand in general, we are substituting, in some cases, oak staves for oak barrels. That is impacting our winemaking costs. Because we are going to increase production, we are able to negotiate a better glass contract. We are looking at contract labor for some of the pure labor areas.

• Our overall gross margin has not really declined that much, but it has been a challenge to obtain our price points, there is no question about that. The question is, do you have to do any support for the price you want? Distributor's allowances are at an all-time high, which is price erosion. So the squeeze in margin comes that way.

• We work really hard trying to explain to growers that price swings are not in anyone's benefit, whether they are going up or going down. Because if our bottle price is going to go up, it is going to go up 1%. We are trying to explain that situation — what is going on in the marketplace.

PRICE COMPRESSION SUMMARY

Most respondents are observing margin compression. Strategies to improve margins include:

- Increasing wine prices where feasible;
- Reducing operating costs;
- Improving operating efficiencies;
- Emphasizing relationships with growers.

Q: *Will consumers return to buying high-priced wines at the levels that existed in 2006/2007?*

• We will not see a return to that irrational exuberance; that was not only connected to wine, was it? It was connected to housing, lifestyle, and spending habits. We are living in a different environment than we were in that pre-recession era. That being said, the beautiful thing about wine is that it remains an affordable indulgence. Consumers still want to treat themselves to something special.

• No, because there has been a reset. People are more interested in value now than they were. As prices come

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down, people move down to buy even lower-priced wine and find that they enjoy that wine every bit as much as they might have enjoyed the higher-priced wine. My guess is they are not going to move up back into those very high prices again for a while.

• It will come back if the economy comes back, but it will not come back to what it was. Many people traded down during that period, as far as dollars per bottle. I would guess that they like the taste, and I do not know if they are going to go back to buying wines at the expense that they were before the recession.

• Eventually consumers will come back, but it is going to be a slower process than the last recession due to the severity of this recession, and also the fact that they have been buying down and have come across some pretty darn good wines at lower price points.

• It will come back with recovery. People are always saying the market has fundamentally changed, we will never see those prices again — sure. Krug Champagne used to be $300, and then it declined — do you think it is coming back? Sure it is coming back.

They will go back to either stalwart brands that are authentic, or estate-based wine-growing. When people start feeling like the Christmas bonuses are back, and they see that California wines over $100 per bottle are getting 95-point scores, it becomes an "I want to get on that mailing list" sort of thing. Yes, it will come back.

But mainstream luxury-tier players are going to come back to their own new norm. They are going to come back and spend a little more, and seek a little more, and experiment a little more but it is never going to be those days again. The winery is still going to have to give better value than they did in terms of quality, customer service, and attention. The consumer has been trained to ask for deals, too. Even the rich guys are asking for deals.

• I still firmly believe that it is a new wine business; we are in no way looking back at how we did business and how things were, pre-2007 at our company. It is going to be a new good time. But the consumer has been trained to expect more, better wine, better deals, attention, better reception, and those other little value add-ons that a customer-winery relationship has.

• The Harlan [Estate]s of the world will exist and continue to draw a very high price, but there are going to be fewer wineries able to actually attain that cult status or high price. It seemed like (in 2006/2007), everybody around here (Napa Valley) was charging $100 or $125/bottle, and that is a fairly glorified world. There are fewer hedge fund operators, Wall Street investment bankers, and deal-makers employed. That was a one-time phenomenon. We will not see that again.

• We like to refer to those wines as "what the heck wines" – when you are looking at the wine list and you just made a billion-dollar deal in Silicon Valley and you just say "what the heck." There is certainly not as much of that. It may return; we are seeing some very positive signs with our highest-priced wines that retail for $200 – $300 per bottle. It is better than it was in 2008 and 2009, but it is not back to pre-2007. It is very hard to prognosticate that. It is about half-way back.

• We have actually seen some improvement in demand for upper-end wines in early 2012. Is it as strong as it used to be? No, no doubt — it used to be that they just flocked in and bought multiple cases. But we have had some very good retail trends at the winery itself.

• The most important lesson we had (as an industry) when the world changed in 2008/2009/2010, was the power of the balance sheet. What I mean by that is a husband and wife sitting at the breakfast table have this conversation: "We were worth $1 million last year, and after this market crash we are down to $700,000. What does that mean? It means our retirement plans are set back five years – what can we do about it? We could go out to restaurants less frequently, and while we really enjoy that $15 bottle of wine we have almost every night,

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maybe we are going to have to downgrade to $9/bottle."

So people trade down and they channel-shift. The question is: when is it going to come back? I do not know. If the stock market had two to three consecutive solid growth years, I would say we would be back to 2007 levels.

HIGH-PRICED WINES SUMMARY

- Respondents have varying opinions;
- Many believe consumers will increase purchases of high-priced brands:
- Slowly as the economy recovers,
- With an increased focus on quality and authenticity;
- Previous levels of conspicuous consumption will not return;
- Many respondents note that consumers have traded down, and may have "reset" their wine preferences at lower price points;
- Some respondents note that they are already seeing improvements in sales of high-priced brands.

Q: *Are you observing shortages of qualified labor in either the vineyard or winery? What are you doing about it?*

• Yes, our biggest issue is vineyard workers. When the harvest has to come in and time is short, that is really when you are pinched, because everyone needs them at the same time. We have increased mechanization; machine-harvesting more than 50% of the grapes that we own. Because we know that is going to continue to be an issue, we are planting new acreage so it can be machine-harvested. We are also utilizing farm labor contractors as much as possible — you need to solidify your agreements prior to harvest. The last thing you want to do is be ready to harvest and not have a labor force. We are looking into the H-2A program.

Editor's Note: H-2A is a program providing immigration authorization for temporary, seasonal workers. More information can be found on the Department of Labor website: www.dol.gov/compliance/guide/taw.htm.

• Yes, we are seeing labor tighten up in certain areas in California, and during certain times of the year. I see more labor issues in the vineyard than in the winery, especially when we are competing with other crops. We are planning to decrease our needs for labor through mechanization, and increase training and education programs for our employees. We are looking at the potential in California for H-2A programs.

• There are sporadic issues with respect to the vineyards. It really boils down to what are the competing crops, what is happening near the growth lifecycle, and what kind of labor they need there. At times there is sufficient labor and, at times, it is a little bit short. We may delay leafing or thinning processes a couple weeks until the labor becomes available. However, we cannot delay harvest, so we are hoping there is not a significant overlap in demand for other crops at the same time. This situation occurred a couple of years ago — there was a two-week period where people had to pay a premium in order to get the crews in to harvest.

• Alternative crops are creating huge demand for labor, and it is coming at the expense of the wine/grape industry. This is going to spur some mechanization — managers are always looking at that for cost reasons anyway, but short-term, we are going to see an issue that we had in 2011 where we could not get labor in the field. I remember that, in Lodi, they had an issue when the INS came through — it shook up everybody and they could not get the crews in.

• We are not having problems, but are paying more to get people. In mid-season 2012, we increased what we paid for all of our labor, that we seldom do, primarily because of labor mobility. People are living in Fairfield or the Central Valley and are commuting to Napa or to the Coast. But the biggest thing is there are fewer people in the crop-related labor force.

• I have never seen such a huge labor shortage in the vineyard. It has become so bad that one of our neighbors was actually offering a $5,000 bonus to people who would come to work for him. It is the worst labor shortage in my 25-year career, in the vineyards alone. We actually went to an outside labor contractor. We transferred the liability of employees and the risk of farming labor shortages to the contractor.

• Not materially. I would say marginally it has tightened up a little bit. We have a long-term, well-paid, large full-time crew that works in our vineyard. We have a pretty good relationship with them. If you pay well, you get people. We are able to get the people needed and have not experienced it directly for the vineyards we farm and our wineries.

• We have a dedicated H-2A program that we inherited s o that has provided a constant pool for us.

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• No problem. We have a whole group of people that we have worked with, and we seem to be able to get what we need. We can get more than we need in the winery. We are not hiring anyone, because we are hunkered down in this environment and we figure why increase our exposure?

LABOR SHORTAGE SUMMARY

None of the respondents are experiencing winery labor shortages. Most respondents are observing vineyard labor shortages. Strategies to manage vineyard labor shortages:

- Increase wages and benefits to attract employees;
- Utilize labor contractors;
- Increased use of mechanization.

Q: *What will be the hottest issues over the next five to ten years?*

• Water is going to be a huge deal over the next five to ten years. The regulation of water, and grey water recycling are going to become greatly important, especially in California.

• Water issues, restrictions, and moratoria on well-drilling in Napa Valley. People are drilling wells to make sure they secure their source. Water is always going to be an issue here in California.

• The water issue is huge. The labor issue is huge unless we can further mechanize. Some people are trying to mechanize with mixed results. We cannot cut farming costs without decreasing quality. Good wine is still going to need oak ageing and oak barrels, etc.

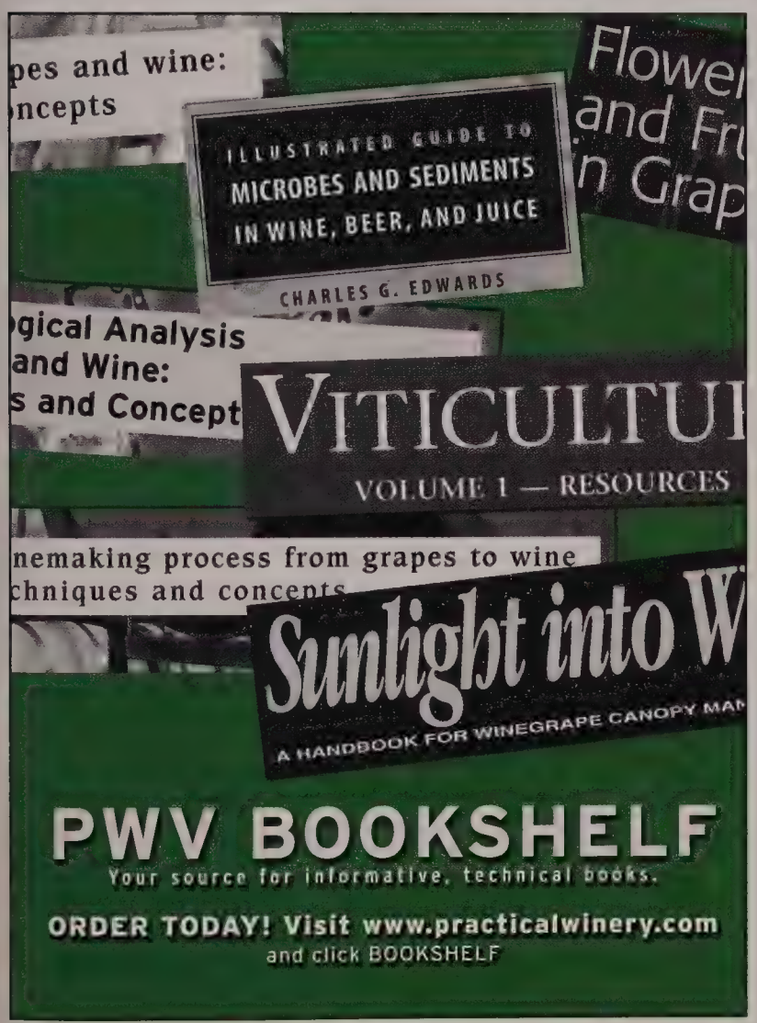
We are going to have slightly altered packaging using screw caps and bag-in-box. Our best bet is to really try to get the wine and food lifestyle more closely paired.

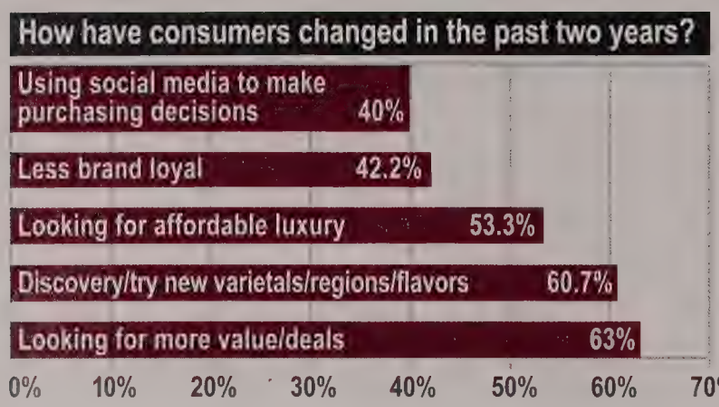
• Packaging is going to change. The 3-liter bag-in-box is a great idea. The only question is why does it end at $19.99? There are a few brands that are over $19.99, but you will see more of that. We will see $40 to $50 3-liters in the future.

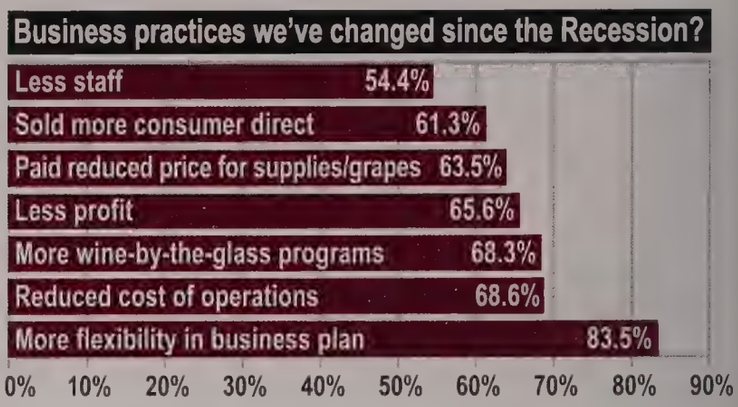
• If demand continues to grow the way we see it growing, supply is going to be an ongoing issue. The cost of real estate is going to be an issue. Right now you can still get planted vineyards at a reasonable price and that is going to go up; the cost of land is going to go up. Labor will continue to be a problem. And there are so many planting regulations!

• In the San Joaquin Valley, we have the air pollution control district, which has basically determined that wineries are equivalent to petroleum processing plants. They are charging us for every wine tank that we have, regulating the amount of tanks we can put in, and requiring us to register as a major polluter. That is just more money, more paper work, and more regulation.

• The pressure on **responsible drinking** is going to continue to be a big issue. Government will get involved. The health impacts of drinking are a big issue; DUI is a big issue. If the state coffers remain as challenged in the next few years as they are today, the states




How have consumers changed in the past two years?
Using social media to make purchasing decisions 40%
Less brand loyal 42.2%
Looking for affordable luxury 53.3%
Discovery/try new varietals/regions/flavors 60.7%
Looking for more value/deals 63%
0% 10% 20% 30% 40% 50% 60% 70%


Business practices we've changed since the Recession?
Less staff 54.4%
Sold more consumer direct 61.3%
Paid reduced price for supplies/grapes 63.5%
Less profit 65.6%
More wine-by-the-glass programs 68.3%
Reduced cost of operations 68.6%
More flexibility in business plan 83.5%
0% 10% 20% 30% 40% 50% 60% 70% 80% 90%

and the federal government will look at taxation.

A couple of really exciting aspects of the business are the incredible pace of innovation and the crossover appeal of wine with food categories. There is Skinny Girl vodka, Skinny Girl wine, chocolate-flavored red wine, flavors and styles that if we had this conversation five years ago would not have entered into the vocabulary. The pace and breadth of innovation is incredibly exciting.

The pouch is now becoming a more popular vehicle for consumers to enjoy wine. Someone has come up with a paper bottle. I have no idea what is next but I suspect we will be drinking wine out of cans very soon. Overriding everything else is the global interest for wine and the increasing pace of globalization.

You take a brand like Layer Cake — consumers do not know where it comes from. It is like a discovery for consumers. It used to be you had a brand from a region with a few varieties that matched that region, and now you have a brand like Layer Cake that is Primitivo from Italy and Malbec from Argentina — a great example of globalization from a supply and branding perspective.

• I would be very surprised, unfortunately, if we do not see another supply cycle. We are going to get a significant acceleration of planting, and five years from now we are going to flip from a shortage to a surplus. It will not be as severe as in earlier generations.

Big producers and even mid-size producers are looking at the relative economics of Chile, South Africa, Australia, and Argentina. Particularly, "California brands" increasingly switch supply from country A to country B to country C. I use "California brands" in quotations, where that was never done 10 or 15 years ago. You either had a California brand or an import brand. You did not have a Chilean Cabernet, an Argentine Malbec, and an Australian Chardonnay being sold under the same "California brand." This is going to help smooth out some of these cycle peaks that occurred in the past.

• Globalization in terms of domestic sellers looking outside of domestic markets. Everybody is focused on the U.S. as the place to sell, because we are the biggest economy and have the biggest wine economy. So we will only continue to gain momentum.

• I see nothing that has fundamentally changed the structural long-term secular trend, of wine consumption in the U.S. continuing to grow. It obviously moves around the trend line. I continue to see a small increase in premiumization. Maybe not at the rate that happened in the 1980s and 1990s, but that will continue to be a trend within the long-term overall growth. In ten years, I do not see anything from a consumer psychographic view point about product that is negative.

• There is competition for land and the value of other crops affecting us right now. We are competing to find good land where growers are willing to plant grapes rather than some other crop – be it berries in Santa Maria or almonds in Fresno. That is a big issue.

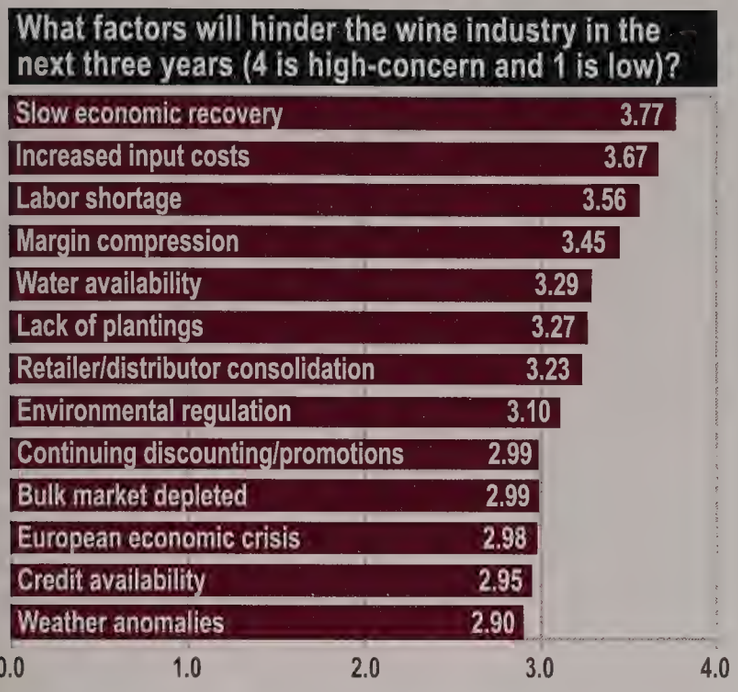
• The issue we are dealing with is the competition for vineyards from other crops like almonds, walnuts, and pistachios. If that continues, it reduces the supply of bare land, which is forcing prices up. The prices of grapes have to go up to compete with that. Another big issue could be the concern about water, and global warming and how it might affect California.

• The wine category in the U.S. will grow dramatically over the next ten years. It fits very well into the evolving culture of this country, and there are some very soft health benefits to wine as a choice versus other categories. I really believe that it is "in" and will continue to be "in" as you can see from millennials. How people use the Internet, digital marketing, and social networking really helps exploit the growth opportunity. In the last few years, we have seen that one of the sparks to growth is tapping into being authentic with consumers through the Internet.

• We will continue to see a massive retail consolidation in terms of the big grocery stores. We are not going to get ourselves around this distribution. We will have to find a way to get our product to market. There will be more and more direct shipping and direct-to-consumer business. The way small- and medium-size wineries will survive is to be much more efficient using the Internet and all of the social media that allows them to build and sustain their business.

• The biggest concern is going to be the true dominance of the retailer. Total Wine, Costco, Safeway, Publix, et cetera, you name them — the top ten major off-premise retailers are absolutely going to determine who the winners are. The little guy is going to get increasingly taken out of the retail discussion.

There will be more emphasis on direct-to-consumer for the wineries getting rationalized out of the retail sector. There will be an increase in smarter customer relationship management modules and algorithms. We are going to look more like Amazons than Gallos. At the end of the day, you will have to have a selling proposition; your wine is going



to have to be worth waiting for the UPS driver.

• Shelf space — We are competing more now than ever on the shelf for wine space, and there is some loss of wine space to craft beers and other products that will continue to erode the opportunity for vintners to be on the shelf. We predict that will increase substantially. While there is wine in more accounts than ever in history, the amount of space given to wine is going to be cannibalized by other products, and specifically products that can buy real estate on the shelf.

• My biggest fear — and I do hope that this would not come to pass — is if Granholm got reversed at the Supreme Court. That would be disastrous for some wineries.

• Possible grape shortages. In 2011, we sold 330 million cases in America. Everyone has to be certain that the right varieties are being planted and that we have enough juice for the future. We are the largest consuming wine country, but when you take a look at the per-capita, we have such a long way to go. If we drank as much per capita as the UK, we would be at 700 million cases. If we had the same per capita as Spain, we would be at 850 million cases.

• The biggest thing is the demographic shift that is occurring. The two biggest demographic groups are the boomers and the millennials. As the boomers are getting older they are going to have less buying power or reduce their consumption. The millennials are adopting wine at a faster pace than we have ever seen. They seem to be a group of consumers that are motivated by different things. So tapping into and understanding demographic shifts will be really important for us.

• The millennial is going to be in full swing. We are going to sell a lot of wine. The question is what price point will it be at and where will it be coming from? The American wine business, at $15 and below, will be rock-solid over that time-frame. At the higher price points, I am not sure if the consumer is going to grow into a collector or a consumer.

• Take climate change — and it is just not this overall warming trend. To me, climate change is emerging with extreme weather events – what happened in the southeast, what happened in Beijing, what is happening in the west and southwest with droughts or heavy rains. That scares me to death out here, just in terms of crop.

• Bloggers, if they are not able to move sales, are going to not be as important. They may go away over the next five or ten years. The only people that read blog sites are other bloggers, but are they buying wine? If they cannot influence buying decisions, that whole aspect will go away.

• The green pressure on wineries is much stronger in the UK than it currently is in the U.S. There was a flash about five years ago where Walmart and Sam's Club started to put the heat on [companies] for their carbon footprint. I do not hear as much about it as I used to, but that is going to come back. As the economy gets better, people are going to start thinking about the world and doing the right things for the environment. ■

TOP ISSUES (In order of frequency) SUMMARY

- Globalization and competition from imports
- Government regulations (labor and environment)
- Water availability
- Distribution and retail consolidation

OTHER ISSUES

- Taxes
- Competition for land
- Climate change
- Packaging innovation
- Supply cycles (shortage and surplus)

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Virginia wineries

Best and Worst business decisions

BY David Furer

Twenty years ago, in the early 1990s, some of Virginia's early attempts at fine *vinifera* wines were dire and most middling, with a few good examples from a handful of producers. Dennis Horton was one of a few U.S. pioneers of Rhône varieties achieving a modicum of success.

Since those bygone days, the numeric rise of Virginia wineries and the rapid increase in quality for reds and whites (and a few bubblies) have made Virginia a force to be reckoned with.

The care and intelligence applied by Virginia wine producers to grape-growing, resultant wines, business management, and hospitality have made their wineries among the best in the U.S. Increasing collaboration between Virginia wineries and growers, along with greater interest originating from outside the state, have spurred growth.

Noble varieties such as Riesling have given way to others better suited to the region, most notably the state's "signature" grapes of Viognier and Cabernet Franc, along with Petit Verdot and Petit Manseng.

Of the nearly 200 wineries in Virginia today, the five largest — Williamsburg (54,000 cases/year), Horton (30,000 cases/year), Barboursville (37,500 cases/year), Chateau Morrissette (60,000 cases/year), and Prince Michel (27,000 cases/year) — account for about 40% of the state's annual 488,000 (2011) case volume.

Most sales are cellar door, long money to be sure, but due to recent market pressures many reds are released and drunk too early for ideal enjoyment. Newer producers sometimes lack expertise, and unpredictable weather is a ubiquitous concern for all. There are no cooperages in the state to work with Virginia-grown oak, much of which is shipped to France for processing.

For locally-grown grapes (*vitis vinifera* only) best prices are gained in descending order from Petit Verdot, Cabernet Franc and Cabernet Sauvignon, Chardonnay, Viognier, and Petit Manseng. All of these comprise the best of what Virginia wines offer today.

Barboursville Vineyards

Developed by Gianni Zonin of Italy's historic winemaking family, and overseen by winemaker/GM Luca Paschina, Barboursville Vineyards is now among Virginia's "old guard."

A western slope (1,300 feet) of Cabernet Sauvignon at Glen Manor Vineyard, looking southwest across the Browntown Valley to the north face of Hogback Mountain, 3,400 feet, part of Shenandoah National Park.

The native Piedmontese Paschina arrived in 1990 and set about planting 120 additional acres to the original 50 acres (total of 170 acres), which today represents 6% of Virginia's viticultural acreage.

The historic "1804 Inn" is adjacent to the ruins of a house designed by Thomas Jefferson for Virginia's then-governor James Barbour. The on-site Palladio Restaurant is one of the top winery restaurants in Virginia, if not on the entire East Coast where 6% of Barboursville wine production is sold and 40% is sold in the art and winery visitor center.

Barboursville's *raison d'etre* are Italian varieties Sangiovese, Nebbiolo, Barbera, and Moscato, along with Cabernet Franc, Merlot, and Chardonnay, Vidal, and Riesling. The flagship is the Octagon Bordeaux-style blend (mainly Merlot and Cabernet Franc with some Cabernet Sauvignon and Petit Verdot).

Luca Paschina reports, "When I first came to the U.S., there was great pressure to make wine in a New World style, oak-fermented with some residual sugar. Where I come from

in Piedmont, we prefer a more crisp and refreshing style with an absence of obvious oak. Wholesalers and retailers told us that their customers wanted a New World style, but we chose to keep our Old World style.

"In time, we gained clientele who appreciated this and now we see this style coming back into fashion. Virginia's climate is more suitable for this, especially reds that are a bit more astringent in their tannins, though we could have gone the other way with the whites as they allow more flexibility.

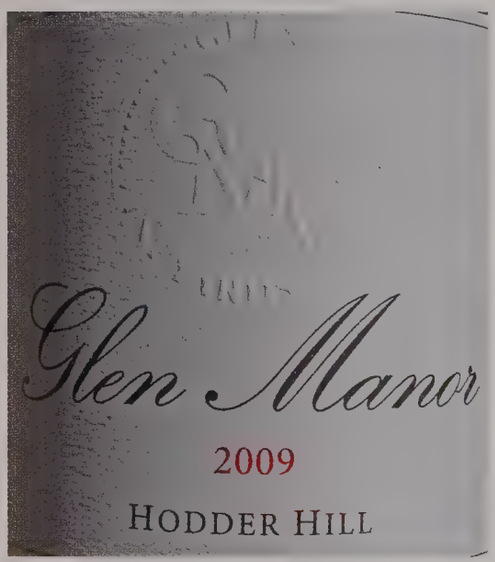
"I don't think we ever took a decision which cost us an overly high price, but we have insisted on making Pinot Noir from six acres (1990-2001). This was a mistake — with the exception of the cool 1997 vintage. We invested $25,000 per acre and sold the wine so we really paid for it. We never received praises; it was OK wine but nothing great. The grape was planted in the wrong place, which has since been replanted to Sauvignon Blanc. There may be some cooler sites in the higher Shenandoah elevations suitable for Pinot Noir, but not here at Barboursville in the Monticello AVA."

Glen Manor Vineyards

"I was strictly a grower for a decade before starting a winery," asserts Jeff White (proprietor, winemaker, vineyard manager). It was a decision he says is the best and worst he has made.

In addition to grapevines, he and his family had been growing white pine Christmas trees and raising some cattle on a 226-acre farm. They now lease out some of the pastureland deemed unsuitable for grapes to a neighbor for grazing needs. There are 14.5 acres of vineyards with an additional 100 acres suitable for high-quality grapes, though currently upon a steep, rocky, and forested hill.

"This is a family-owned and family-operated farm since 1901 when my great-grandparents purchased it," White recalls. "In the mid-1990s, I got interested in grapegrowing and planted a small block on the farm, selling grapes for 10 years to Linden Vineyards while working as the winery owner's right hand man for 12 years. There, I gained a lot of information, training, and confidence in how to make wine.



Flagship wine: Hodder Hill (Bordeaux blend of predominantly Cabernet Sauvignon, Merlot, Cabernet Franc, and Petit Verdot).

"The grapevines were well-established when I was ready to start my winery. It was not profitable at first, working two jobs, yet our farm at the time was free and clear of debt. Now it is not," he laments, adding that a big chunk of it is now owned by a bank. "We are not in the black yet, but we are fast approaching the break-even point.

"We have added value to our agricultural product, selling wine at retail prices here at the farm (2,500 cases/year production of Sauvignon Blanc, Petit Manseng [both aperitif and dessert], Cabernet Franc, Petit Verdot and Hodder Hill)."

Vines in the original six-acre vineyard (planted 1993) are open lyre trellis, spaced 12 by 8. The 8.5-acre vineyard (planted 2008) is on a very steep (35°) slope with very rocky soils and the vines are double Guyot-trained, spaced 8 by 4. "We have much less vigor in the new vineyard. We seeded grasses in the vine row and increased vine density in the original vineyard to control vigor.

"There is some stress, some risk, but from what we have seen of the business improving, future generations will have the opportunity to farm this land another 111 years and not be pressured to sell to a developer."

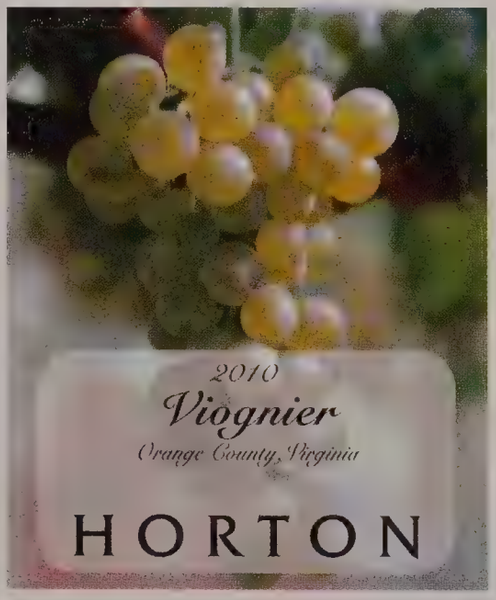
Placing a broad perspective, White assures that "putting my passions of farming and winemaking together was the best decision I ever made. If it fails, and the bank takes our farm, it will be the worst decision I ever made.

Horton Vineyards

"It has been better to be lucky then smart," chortles Virginia's famed Rhône warrior, Dennis Horton. He had to get creative in the beginning because some grapes were not working. However, Viognier has worked well for him for 18 years. "If you cannot make great wine from Viognier, you cannot make wine. It is consistent, both for its sugar content and aromatic profile." He makes 3,000 cases annually ($20 SRP). "It is easy to achieve 23 – 24° Brix with good acidity."

Growing Viognier longer, at least longer than anyone on the East Coast, he has not had problems with Virginia's humidity. Also, he thinks that, even today, too many winemakers over-oak their wines. Of 250 Viognier barrels, maybe only five are new. "You do not have to make a pseudo-Chardonnay out of it." Horton also produces Norton, Petit Manseng, Pinotage, and Tannat.

In comparison, his 10 acres of Cabernet Sauvignon turned out to be a "consistent disaster." Working with Virginia's humidity compared to Napa



Valley's persistently dry climate led him to replant those acres with Cabernet Franc — now up to 12 acres — which idles its sugars 2-3 days before making sugar again following a rain, whereas Cabernet Sauvignon soaks up the water and dilutes the sugars.

Others in Virginia have caught on, and now Cabernet Franc is the most widely planted quality red grape in Virginia, though he says that, "Horton's consistency has helped it in gaining ground fast."

As for his less fortunate choices, he says, "I wish I had not planted Pinot Noir. It all had to do with finding the right grapes for our climate. Unlike people, not all grapes are created equal. If it does not work, then rip it up — but that can get a bit expensive."

Linden Vineyards

"Worst is also the best, as one of the first decisions I made was my failure doing diligence," explains Jim Law. "I started as a winemaker and vineyard manager, but did not have a clue about business matters. Debt would have been fine but, back in the early 1980s, loans were hard to come by.

"You must have land and a building, some equipment, none of which is hard to figure out for a layman such as I was. I found owner-financing and a bank to loan me for a build-out, but I did not understand inventory and operating costs, both of which require a lot of money. I just kept getting into trouble, which took me about 12 years to dig myself out of."

Law farms 30 acres in total, 10 of which are off-site (5,000 cases produced in 2011).

"Getting into this without understanding what I had gotten myself into was also the best decision, because had I understood what it entailed, I probably would not have gotten myself into it in the first place.

"Making the slow, necessary changes to improve wine quality, mainly in the vineyards by pulling out established vines producing the wrong variety or clone, or planted in the wrong soil, was another 'best' decision. I undertook it 10 years ago and continue pulling out more vineyards, all the while replanting.

Hardscrable Red is a Bordeaux blend (60% – 75% Cabernet Sauvignon with varying amounts of Merlot, Cabernet Fanc, and Petit Verdot).

"I could have gone merrily along selling directly at the winery, but I am trying to get to the next level of quality and distribution, which calls for making better wines in order to get into the global game."

Law pulled out a lot of Cabernet Sauvignon in the wrong spots, replanting in better ones. "I planted a lot of Seyval and Vidal, both of which are severely diminished or on their way out altogether now."

He has planted Merlot and Sauvignon Blanc, having avoided Virginia's "sour rot" problem for a decade. He does admit to trouble getting over price resistance to the many competitively-priced Sauvignon Blancs from New Zealand and elsewhere.

Rappahannock Cellars

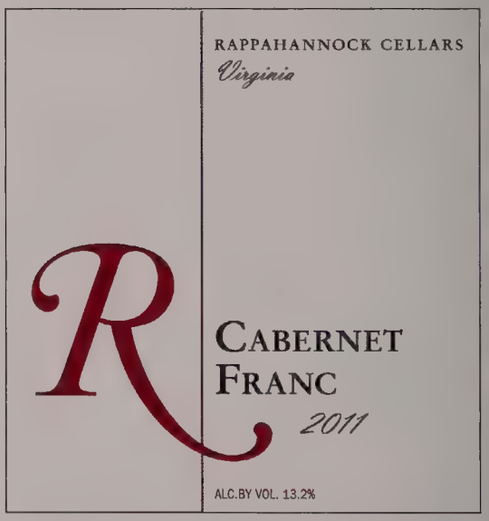
California expat John Delmare set up Rappahannock Cellars in the foothills of the Blue Ridge Mountains in 1998. Why move to Virginia instead of retain Saratoga Vineyards in the Santa Cruz Mountains (California)? "We made offers on places in Mendocino and Oregon, but chose the Piedmont for our family and because of Virginia's burgeoning wine industry."

The former Saratoga Vineyards (now Savannah-Chanel) owner first planted in Virginia in 1999, 20 acres on 70 acres total. He leased more land from local vineyards, growing 80% of the grapes he needed, and opened his doors to the public in 2001.

"Most Virginia wines at that time were weak and I was brash enough to say that I could do better!" recalls Delmare, although 10 wineries are now within 15 miles of Delmare's cellar. Rappahannock's wines are all of a solid standard with his "Solera" (a sweet fortified blend of several years dating to 2000), unusual but well worth seeking out.

"A few years back I gave a Newcomer's Session talk at the Wineries Unlimited gathering in Lancaster, PA; my main point touched upon not properly funding a winery from the outset." He had focused upon his first winery in California having started it on a shoestring and funded it piecemeal, which ultimately cost a lot more money than growing to suit the business — had he capitalized it initially more efficiently.

"The second winery in Virginia saw me acquiring capital from the beginning. We built it properly, equipped it, and produced inventory — often a big problem for new wineries not growing their own grapes — and



aggressively promoted the business. Here in Virginia, we saw the two extremes, one where people look at it as a business and aggressively fund and grow the business and the other where they take the same approach I did in California," referring to the old days of the homegrown wine business, although many places now begin with far more professional aspirations.

"I am one of those lucky guys who has been able to do it all over again, albeit on two different coasts. The first could have been a lot more successful than it was; my current winery has gone terrifically. We have done well in Virginia, achieved a lot of early success, which we have built upon."

Rappahannock produces 10,000 cases per year of Chardonnay, Viognier, and Cabernet Franc, with Merlot and Cabernet Sauvignon blended into a Bordeaux-style wine.

Williamsburg Winery

With an annual production of 54,000 cases from grapes sourced within and outside the state, Williamsburg is one of the largest Virginia wineries. Belgian Patrick Duffeler Sr. arrived at this site in the 1980s and concentrated on Chardonnay as the primary variety with some red vinifera. The most recent plantings include a large percentage of Merlot, Cabernet Franc, but also include Petit Verdot, Malbec, and Viognier.

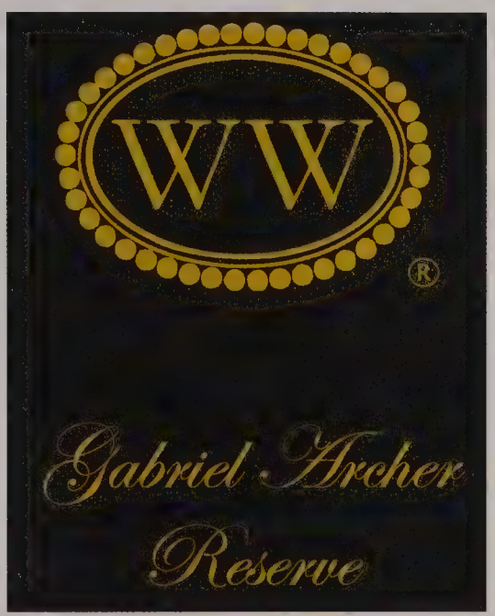
"We have had the benefit of the past 20 years of combined viticultural experience in Virginia to guide us to plant varieties that both thrive in Virginia, but have also received critical and market recognition," says Duffeler.

Duffeler followed in his grandfather's footsteps to the U.S. with a scholarship to the University of Rochester, worked for Eastman Kodak and Philip Morris, and eventually worked with an investment group involved in a Burgundy winery. He acquired farmland in Williamsburg in 1983, planting vines two years later, and made his first wine in 1988.

"I first looked at what consumers wanted to buy, realized Pinot Noir's tight clusters would not thrive here because we are closer to Bordeaux in climate," explains Duffeler. Steeped in an economics background, he demonstrated with graph curves of the best way to structure a winery business.

"I was originally motivated by a Deloitte & Touche study in the 1980s claiming that less than 25,000 cases of annual wine production in the U.S. was not profitable. Since I had no ambition to go into the millions of cases level of profitability, I decided to target production above 25,000 cases/year. We reached that by the late 1990s, less than 10 years from the start of the operation."

Duffeler's alter ego is winemaker Matthew Meyer (ex-Heitz Wine Cellars and Grgich Hills Estate), who was lured away from his northern California home to work with more challenging climates. "East Coast wines are more European in style, expressing more finesse, so are not so bold," says Meyer. "Rain at the wrong times, humidity, critters, tourists, all provide challenges for grapegrowing. We have been learning it for 20 years; they had centuries to get it right."



Gabriel Archer Reseve is a blend of the five Bordeaux varieties, produced only in the best years.

Duffeler continues, "In 2001, we took a deep breath to rethink our organization taking a strategic approach we titled 'back to basics' focusing on quality of the goods, profitability, efficiencies, defining higher customer satisfaction, and better use of technology to achieve business efficiency and customer return. We weathered the recession comparatively well." This was said in light of his being on the board of a regional bank hearing many tales of woe from other business owners.

His son, Patrick II, got drafted to winery duty at an early age. "The decisions we made in 2001 were necessary. It was amazing to see the growth we achieved in the early 1990s. We had no idea the wines would be so well received. We had 30% annual compounded growth, but we came to the realization that feeding the sales force with a large amassed inventory is not enough. Over-committing to a large inventory can lead to trouble; bloated egos and bloated inventories are the greatest detriments in the wine business."

Patrick II had underestimated the lack of infrastructure within the Virginia wine industry, including the unavailability of qualified personnel, the enormous communication challenge to bankers and merchant bankers who believed in the industry, and the expansive costs associated with those dimensions.

"The lack of grapes is one of our biggest concerns," says Patrick II. "The sales of our most expensive wines ($32 and $65), are very good, but the constraints we face stem from the lack of high-quality Virginia fruit. When we are able to reach an economy of scale where we can create a reasonable volume of high-quality wine from Virginia grapes we would be happy. Virginia can market and compete with its wines successfully, but we are not able to supply ourselves to take on larger national or international wine regions."

Duffeler Sr. adds, "At $1,900 per ton of grapes, we cannot make a popular-priced ($12) wine of high quality. We would love to have larger viticultural operations so we would have the benefits of efficiency; but we are not in the San Joaquin Valley. Our weather is more like Bordeaux, if a little bit warmer with its humidity challenges. We could use another 5,000 acres of producing vines in Virginia." ■

SMART VITICULTURE *by Dr. Richard Smart*

China, an emerging global producer?

Much is written about Asia in general and China in particular becoming a great market for exported wine, including from the U.S. The Wine Australia website (www.wineaustralia.com) claims, "China has been the fastest growing export market for Australian wine in recent years, and is now the third largest destination for bottled exports."

For U.S. wine producers, less reliant on exports, China is also seen as an important and growing market. For 2011, according to the Wine Institute, Hong Kong is the third largest market, valued at $163 million, after Europe ($478 million), and Canada ($379 million), with China in fifth place at $62 million. China's growth remains buoyant at 42% per year.

Such figures are reassuring to marketing executives, but there is another side to the story. Wine production in China is rising, fueled by local demand. This column looks at China's growing wine industry, and contemplates what impact it may have on international wine markets in the medium-term future.

World statistics

Statistics from the OIV (International Office of Wine and Vines) released in 2011 show interesting trends. The world's vineyard area is contracting, from a recent high of 7.9M hectares in 2003 (1 hectare = 2.5 acres). China and Argentina are the only two of the top 14 countries with increasing plantings; the rest, including U.S., are decreasing. The vineyard area includes raisin and table grapes.

China is now the third largest grape producer in the world, after Italy and the U.S., and ahead of France and Spain. World wine production is decreasing since a high in 2004. China, Argentina, and Russia are the only three of the top 12 wine-producing countries that are increasing output. China, at 13 million hectolitres, is currently the world's sixth largest producer, after Italy, France, Spain, the U.S., and Argentina. China now produces more wine than Australia (11 million hectolitres).

Wine consumption in the top 12 markets is generally declining, or stable; in only three is it increasing — Australia, China, and Canada. Exports are stable or decreasing; those increasing are from Italy, Spain, Chile, Germany, and New Zealand — the latter showing substantial growth. For countries importing wine, only two markets are growing: the U.S. and China, the latter presently around one-third of that of the U.S.

In summary, China is presently a relatively small market, but rapidly growing, and with enormous potential for more growth. The world's major wine producers — Spain, France, and Italy — face shrinking domestic markets, and will look increasingly to exports — to China and the U.S. As China is one of the few countries with increasing production, in the future it may begin to export wine, as this market may be seen as more profitable than a local market.

Tales from manufacturing, garlic, apples, cider, and wine

Most Americans will be aware of the success of China in manufacturing, but likely fewer of their success in agriculture. China produces 66% of the world's garlic, and 43% of the world's apples. China produces 29.9 million tons of apples, number one in the world. (In second place is the U.S., with only 4.4 million tons.) Some of this apple production is exported as juice concentrate, and is an important source for cider production in many countries.

Inclined vine trunks facilitate burying of the vine. Note also concrete vine posts, and in this instance, basal leaf removal and appropriate shoot positioning. Cabernet Sauvignon, Chateau Changyu AFIP Global, Miyun county, Beijing city area, China.

China is a very large country, the third largest in the world after Russia and Canada. It has an area of 9.6 million square kilometers. China's eastern and coastal climate has high summer rainfall and humidity, and toward the west rainfall decreases, summer temperatures are higher, and winter temperatures are lower.

China has the land and water resources to greatly expand its wine production, and has plans to do so. There are four principal vineyard regions of China: Shandong Province on the coast, Hebei Province west of Beijing, Ningxia Province in central China, and Xinjiang in the far west. I have consulted in the first three of these regions, and will report on Ningxia, where I have had the most recent experience.

Viticulture in China

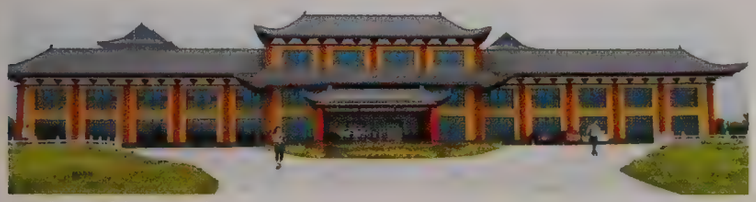
Viticulture in China is generally more difficult than in California. Summer rainfall and humidity cause big problems with fungal diseases, especially near the coast. Further, rainfall (and typhoons!) around veraison can stimulate vegetative growth and hinder ripening. Higher night-time tem-

Photo by Janis Miglavs (www.jmiglavs.com)

peratures near the coast also reduce red wine quality.

Inland, the climate is more arid, and vineyards must be irrigated. Traditionally, flood irrigation is used, and I have the impression that this is done imprecisely. Trellis posts are typically square-shaped and made of reinforced concrete, and foliage and fruit wires are generally loose and often rusty. Many of the inland soils are very deep (I have seen 100 m deep soil profiles!) and most are sandy loam in texture, typically with good drainage.

There are indigenous Vitis species in China, one of which has thorns on the canes! However, most production is from Vitis vinifera varieties, the same as planted predominantly in the U.S. China has had its share of misnomers like other countries. What was thought to be a local selection Cabernet Gernichet was proved to be Carmenere by local DNA testing. The white Italian variety Sauvignonasse (Sauvignon Vert) grows well on the wet East Coast and resists Botrytis.



Modern Chinese winery in Ningxia.

Inland, immediately after harvest, the vineyards are pruned and irrigated, and then buried. Tractors throw up earth banks and these are smoothed by shovel. Vine burial should be complete by early December. Burial does not guarantee survival of vines if winter temperatures are particularly severe.

Viticulture expansion in China

China is committed to expanding wine production. The national conference of liquor-making in 1987 set forth the task of "change from grain liquor to fruit liquor," which brought about a new stimulus for wine development. A common beverage in China is "baijiu," a liquor distilled from sorghum, and the worst-tasting alcoholic beverage I have consumed. The government has decided that grain is for food, and is promoting alcohol from fruit, especially grapes, and especially red wine, good for health. There are current proposals to double wine production.

Viticulture in Ningxia

My present consulting takes me to Ningxia, in Central China. Today, there are some 25,000 hectares of vineyards in Ningxia province; I am not sure if this includes table grapes. There are about 20 wineries. The government program is to increase this area to some 67,000 hectares within 10 years and to have 100 wineries. This will make the Ningxia region the No. 1 vineyard region of China.

Already the local government has planned a "wine route" based on the north/south oriented Helan Mountains (around 3,300 meters) which has begun to attract investment. Great Wall, a Chinese wine company, has planted 500 hectares at the base of the western side of Helan Mountains (at around 1,300 meters).

Other notable wineries involved include large producers Xi Xia King, Changyu, and Dynasty, the Pernod Ricard-invested Domaine Helan Mountain, and a Moet Chandon project supposed to produce sparkling wine in a few years. Asian Development Bank is funding irrigation development to improve efficiency, in which vineyards figure largely.

Existing vineyards in Ningxia

The Ningxia region is arid, with around 16 inches of annual rainfall. Temperatures are very continental, with large diurnal and seasonal differences. Midsummer is hot, like the San Joaquin Valley, but the ripening and harvest periods are cool.

30-inch wide and deep trench with straw in bottom to be backfilled with a soil/manure mix, before planting vines to encourage deep rooting to avoid winter injury.

Chinese vineyards are generally not like American vineyards. Vines are typically planted in trenches in the inland areas with cold winters. Straw is laid at the bottom of the trench, and it is backfilled with soil mixed with animal manure. Harvest and pruning are by hand, and labor is not highly skilled by Western standards.

Irrigation management is generally poor, as are trellising and canopy management. Further, vineyards are often out of balance and overvigorous, with poor fruit exposure and shoot tip growth after veraison. The vineyards are typically quite uneven, with a mixture of healthy, low vigor, dead vines, and often replants. Local experience puts this down to winter injury. Virus diseases are also widespread in some vineyards. The quality of planting material is poor.

All of these problems can be overcome with technical training. Many companies employ consultants, and the above prolems are recognized and being addressed. The University in Yinchuan (capital of Nigxia), offers viticulture and enology classes.

Wines produced in Ningxia

Most commentators are pleasantly surprised by the wine quality, especially for Cabernet Sauvignon, Merlot, and Carmenere. The wines have good color and high natural acidity. In 2011, there was great excitement when local winery Helan Qing Xue saw its Jia Bei Lan wine become the first Chinese wine to win an "international trophy" at the Decanter World Wine Awards in London — and in a category for Bordeaux-style wines, no less.

Further, there was a celebrated "Bordeaux and Ningxia" tasting in Beijing in 2011. Five wines from each region and of comparable price were judged blind by five Chinese and five French judges. The Ningxia wines filled the first four places. There is a general appreciation that the area does now and will continue to produce quality wines.

continued on page 97

COMPLIANCE COUNSELING *by Ann Reynolds, Wine Compliance Alliance*

Straight from the wine aisle:

Decoding wine label language

Reading wine labels is a hobby of mine. I like to call them the marquee on a winemaker's finished product. They are often the first impression a consumer is given and can be very influential in their buying decision, especially if they are not already familiar with the wine they are considering purchasing.

Traditionally, wine has most commonly become familiar to its consumers by first-hand experience — that is through tasting or drinking. There is however another route that anyone viewing a bottle of wine can use to assess the product inside the bottle via the item on the outside — that is the label.

Following are some excerpts from my book, *The Inside Story of a Wine Label*, which breaks down in detail all required and non-required items on U.S. wine labels. The book is designed to educate wine consumers and make their wine shopping and drinking experiences more interactive. Each excerpt I will share here is accompanied with a real-world label example from a wine currently available for sale as I came across each of them via a recent local grocery store search.

Excerpt #1, Chapter 11: Vineyard designate

One item often seen on wine labels is what is called a vineyard designate, which is a term for a specific vineyard name listed on the label. When a winery chooses to include the name of the vineyard, farm, or ranch from which the grapes used to make the wine were grown, the minimum required percentage, per TTB regulations is 95% .... the use of a vineyard name is yet another marketing tool .... those who really pay attention may begin to notice certain vineyard names appearing on labels from multiple wineries, because grape growers often have relationships with multiple wine producers. The savvy wine consumer can potentially use vineyard designate labeling as another shopping guide, developing preferences for certain characteristics related to certain vineyards with which they become familiar.

The example I found to demonstrate the use of a vineyard designate is from Vino D' Angelo (Amador County, California), for their 2008 Zinfandel. Their use of Shake Ridge Ranch tells us their blend has at least 95% of its fruit from that specific named vineyard site. To clearly identify and track those details when they were making the wine, the winery would have needed to include the "Shake Ridge Ranch" name on records such as weigh tags and work orders throughout its life until bottling.

Excerpt #2, Chapter 8: Varietals

... A varietal name is a very common search item for wine consumers as they grow to prefer specific varietals of wine. As stated previously, the TTB's (Tax and Trade Bureau) varietal label regulations require that a blend be made up of at least 75% of the stated varietal. More than one varietal can also be put on a label. Two or more can be listed on the front label, and in that case the percentages of each must also appear next to them with their total adding up to 100%.

RIDGE 2009
LYTTON SPRINGS®
71% ZINFANDEL, 23% PETITE SIRAH, 6% CARIGNANE
DRY CREEK VALLEY 14.5% ALCOHOL BY VOLUME
GROWN, PRODUCED & BOTTLED BY RIDGE VINEYARDS, INC.
650 LYTTON SPRINGS ROAD, HEALDSBURG, SONOMA COUNTY, CA 95448

Here is a current example I found of this multi-varietal front label style from Ridge Vineyards on their 2009 red blend:

Many avid wine consumers are very interested in such full details on a wine's blend composition. Since this particular blend from Ridge does not qualify to only list one varietal on its label (minimum percent required for that is 75%) they may have, instead, chosen to list the three here to give their customers a more intimate connection with the wine at first glance.

The other option available to wineries listing the varietals that make up a wine blend is to list them on the back label, like this one from Ménage à Trois for their 2010 Rosé:

Excerpt #3, Varietals (example 3)

Wineries also have the option of listing their varietals in their blend on the back label. In this case, they do not need to list all of the percentages, but they do need to list the varietals in descending order, down to any varietal that accounts for at least 5% of the blend.

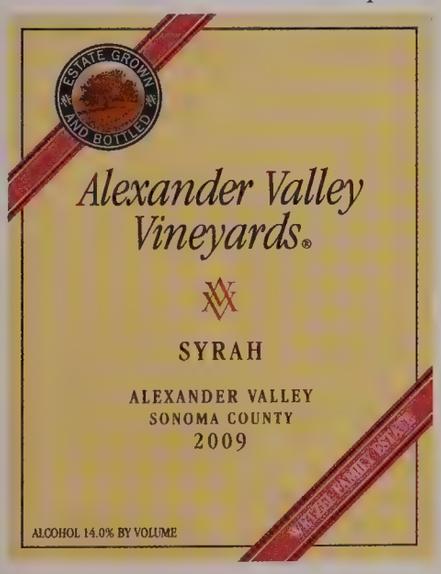
Ménage à Trois
ROSÉ WINE
A delightful blend based on three varietals—
Merlot, Syrah and Gewürztraminer.
VINTED AND BOTTLED BY FOLIE À DEUX WINERY
ST. HELENA, NAPA COUNTY, CALIFORNIA 94574
www.menageatroiswines.com

Listing "Merlot, Syrah, and Gewurztraminer" on their back label not only gives their customers more intimate details on the wine than just stating "Rosé Wine" alone; it also is an ongoing educational tool to get consumers familiar with varietal names. As I mentioned above, listing the varietals on a wine label has become something consumers are used to seeing, so it is really both a marketing and educational tool that wineries are using.

Excerpt #4, Chapter 10: Appellation

An appellation can be a marketing tool. Because well known and desirable wine grapes are grown in specific AVAs (such as Napa Valley, Russian River Valley, etc.), having that AVA on your label implies a level of quality to the consumer. Of course some AVA names will not look familiar to consumers, so it has become a common trend for the county name to be put immediately below the AVA name on a label. This is to assist the customer in knowing where the grapes were grown.

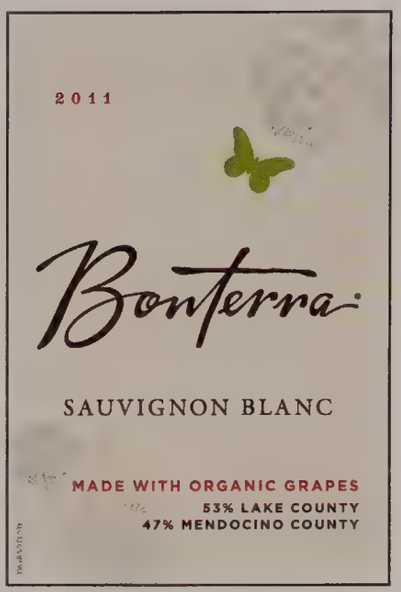
I spotted the 2009 Alexander Valley Vineyards Syrah on the shelf as an example of this double appellation style. This has become much more common in recent years as the number of AVAs (American Viticultural Areas) has now increased to over 200 across the U.S., with 53% of them in California.



One other example I spotted of a double appellation style is the multi-county designation on the Bonterra 2011 Sauvignon Blanc.

Since I did not describe this label regulation in the book, here are the federal regulations for it:

An appellation of origin comprising of two or no more than three counties in the same state may be used if all the fruit was grown in the counties indicated, and the percentage of the wine derived from fruit in each county is shown on the label.



For example, wineries have a full range of appellation options wineries when designing their labels. With 53% of the Bonterra Sauvignon Blanc's grapes from Lake County and 47% from Mendocino County, it does not meet the minimum requirement for a single county appellation (75%). This means they would have had to cast a wider net to the next level, in this case either the AVA North Coast (encompassing the counties of Napa, Sonoma, Lake, Mendocino, and parts of Marin and Solano), or jump from there to listing California as the appellation on their label. Listing the two counties where the grapes were grown is a more accurate designation.

When I teach groups about the details that live on a wine label, I tell them they will never look at labels the same way again. Once you become familiar with what all of those items mean your perspective is forever changed. You become a wine label nerd, and besides having acquired a new skill with which to impress (or bore) your family and friends, this knowledge makes your wine shopping and drinking experience more interactive, and therefore much more enjoyable. ■

The recently updated version of Ann Reynolds book is currently available for purchase on Amazon.

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February 5 – 8
Washington Association of Wine Grape Growers' Annual Convention
Three Rivers Convention Center
Kennewick, WA

A four-day annual convention with opportunity for the industry to network, check out the latest products and services, and learn how to craft quality across every spectrum of the Industry. A two-day trade show will have up to 180 booths. The convention program examines many topics that address how to produce quality. Among the panel topics are: Will Immigration Reform Drive Mechanization?; Professional Development session for the Next Generation; Managing Risks Inside the Winery — Water, Waste, and Safety; and a three-part "Year in the Life of a Grapevine" short course.

For additional information or to register, visit the WAWGG website: www.wawgg.org.

February 6 – 8
Viticulture 2013
Riverside Convention Center
Rochester, NY

Presented by the New York Wine & Grape Foundation (NYWGF), in conjunction with Cornell Cooperative Extension. Important topics in viticulture, enology, marketing, public policy, and more will be presented, including a special focus on cold climate grape varieties, with university scientists from the East and Midwest involved with the Northern Grapes Project. A trade show will have many exhibitors, and networking opportunities for members of the North American grape and wine industries.

Wednesday, February 6

The Big Picture: Past, present & future; major trends in the grape and wine industry, and factors affecting consumer choice • Overall trends in the American wine market • Specific wine market trends • Why consumers buy what they buy • New York in the big picture, challenges and opportunities for New York wines • Perspectives on the market for grape juice and other products.

Northern Grapes Symposium: Consumers and Markets. • Northern Grapes Project baseline survey and economic impact • Challenges and opportunities in emerging wine regions • Models of collaboration among wineries, economic development agencies, and tourism promotion in Michigan. Enology — Yeast strain selection influences wine characteristics and flavors in Marquette, Frontenac, Frontenac gris, and La Crescent • Chemical and microbiological strategies for acid reduction • Enological tannins for Northern winemakers?

Marketing to Millennials and baby boomers/social media update • Marketing orders for research and promotion. • Marketing New York wines in New York City •Succession planning • Business climate for grapes and wine • Working with media • Riesling reflections: the state of the grape.

Northern Grapes Symposium: Viticulture — How climate influenced grape maturity in 11 Northern grape variety trials from South Dakota to Massachusetts • Performance of Marquette, Frontenac, and La Crescent under four different training systems • Sulfur and copper/lime fungicide sensitivity of 12 Northern grapes cultivars • Grapevine nutrition: Results of tissue and soil analyses.

Thursday, February 7

Viticulture/Enology price, quality, and economics: the triple bottom line • Renewable Energy • NYWGF Key Programs (Focus on Export) • Introduction of new cultivars • Dry Rosé Production • Fungicides/Sprayer application technologies (*Eligible for NY & PA pesticide credits*) • New fungicides for grape disease management • It doesn't matter what you spray if you don't get it on • Variable rate spraying in precision viticulture: the use of electronic devices to improve application efficiency.

Restaurants and Locapours: Does "local" really matter? • What's legal and what's not: New York's ABC law.

Innovative packaging, sponsored by AstraPouch/IMPAQ.

Frost protection methods • Frost protection strategies in Northeast Ohio vineyards • Benefits and cost effectiveness of wind machines for frost/freeze protection in bulk juice varieties • Using abscisic acid to improve freezing tolerance and soluble sugars in buds of Cabernet Franc and Chambourcin grapevines • Vine hardiness and impact of seasonal weather.

Friday, February 8

Enology/Viticulture plenary session: Changing times, adapting styles • Wine flavor and perception • Bulk variety production, characterizing the effect of location and crop load on Concord vine and fruit development • Soil variation and vine size (non) uniformity in Lake Erie Concord vineyards • Grow big or grow home: Eastern viticulture vine size economics • The world beyond Riesling.

NCPN: Towards more availability of virus and Crown Gall-tested nursery stock • National Clean Plant Network (NCPN): What it will do, what growers can expect, and Cornell's role as an NCPN center for the Eastern U.S. • Revival of Grape Nursery Certification Program • Crown Gall elimination.

Integrated Pest Management (*Eligible for NY & PA pesticide credits*) • Management of summer and sour rots/Overview of OMAFRA's IPM website and diagnostic key • Managing phylloxera on own-rooted vinifera/Use of entomopathogenic nematodes for management of Japanese Beetle • Phenology-based degree day model for grape berry moth management • Using NEWA resources in a vineyard IPM strategy.

Wine clubs, loyalty programs, and gift cards: keys to success.

Winery Wastewater • Soils • Sustainability programs • Long Island leads the way in certification and product labeling • National Grape Cooperative uses VineBalance to evaluate grower-members' practices • Finger Lakes continue to explore options.

For registration and more information, go to vit2013.com.

February 20
Sustainable Viticulture Conference
Warren Wilson College, Asheville, NC

The Sustainable Appalachian Viticulture Institute, Jewel of the Blue Ridge Vineyard, and Warren Wilson College, host the Third Annual Sustainable Viticulture Conference. Speakers will share information on how to grow grapes organically/biodynamically, how to design a small sustainable winery, winemaking chemistry know-how, making biodynamic preparations, and how to make wines from organically or biodynamically grown grapes. Conference registration is $60 (advance) or $75 walk-in. *Online registration is available at www.GrapeSAVI.org.*

February 21 – 23
2013 Cold Climate Conference
Crowne Plaza Saint Paul Riverfront, Saint Paul, MN

Three-day conference dedicated to continuing education about cold climate grape-growing and winemaking for the beginner to the professional, hosted by Minnesota Grape Growers Association.

Thursday, February 21

Private pesticide applicators: pre-certification training workshop • Winery sanitation seminar • Developing a spray program for grape diseases • Bottling • "Minnesota Hot Dish" Welcome reception and happy hour in trade show • Dinner with keynote address by Sara Spayd (North Carolina State Univ.).

Friday, February 22

Grapegrowers/Winemakers roundtable

• Enology: sweet wine production • Viticulture: Northern grapes training systems/canopy management studies to improve fruit quality • Marketing: are your grapes profitable? • Enology: yeast selection • Viticulture: organic grape growing • Marketing: Minnesota Department of Revenue audit • Enology, Blending • Viticulture: Canopy management, leaf pulling, and shoot thinning for fruit exposure • Marketing: food and wine • Enology: Methods of clarification and microbial stability • Viticulture: Growing and marketing table grapes • Marketing: Farm Credit.

Saturday February 23

Bar Camp • Enology: Wine Faults • Viticulture: When To Harvest? Practical Harvest Parameters • Marketing: Wine Clubs • Minnesota Grape Growers Assoc. Annual Meeting, working lunch • Enology: Tannin use • Viticulture: Organic Grapegrowing • Marketing: Wine Tasting • Enology: Aeration, Oxidation, SO_2 Hands-On lab • Viticulture: Vineyard Floor Management, Weed Control, Cover Crops.

Gold Medal Gala and Awards Night: 7pm. Four-course pairing with 2012 ICCWC Gold medal winning wines. $65. For more information and registration: http://mngrapegrowers.com/

March 5 – 8 Eastern Winery Exposition Lancaster County Convention Center, Lancaster, PA

Tuesday, March 5

Welcome Wine Reception co-sponsored by Pennsylvania Winery Association, Ohio Wine Producers Association, and "License to Steal" National Wine Marketing Conference.

Wednesday, March 6

Avoiding oxidation in small wineries • Sustainability programs in the East • Lab trials for fining agents • Vine size, vine capacity, crop load, and vine balance • When and why you do wine analyses • Phenolic management for aromatic white wines. Exhibit Hall 11am - 6pm • Turning customers into brand ambassadors • Combined titrametric analysis of TA and YAN • Social media for wine marketing #1: what's new in tools and trends • Social media for wine marketing #2: guided facebook exercise • Winemaker roundtable: Seyval, Viognier, and Traminette • Annual EWE industry celebration dinner.

Thursday, March 7

Exhibit Hall 9:15am – 2:15pm. Soft reds and hard cash • New pomace fly pests • Winery energy savings: new (and re-visited) technologies • Fungal disease update • Winery energy savings in action (panel) • What good plant material looks like • Winery accounting debate: cash or accrual, and who's winning • New technologies in the vineyard/winery • Best new event and money-saving ideas • Strategies for sour rot reduction/avoidance.

Friday, March 8

Hard Cider workshop. varieties and styles • Production and stabilization • Ice cider — Liquid gold? Registration and more info at: easternwineryexposition.com

Co-located events occurring in conjunction with the Eastern Winery Exposition: Pennsylvania Winery Association Annual Meeting, Tuesday, March 5 (Separate registration required) open to Pennsylvania Winery Association members. *For more information and registration, contact Jennifer Eckinger at 717/234-1844 or pwa@pennsylvaniawine.com.*

NEW Grape Grower Workshop, Friday, March 8, (Separate registration required). Dr. Joe Fiola (Univ. of Maryland) and Mark Chien (Penn State) present a commercial winegrape vineyard development workshop for beginner and prospective winegrape growers. *For more information, contact Mark Chien: 717/394-6851 or mlc12@psu.edu.*

UC Davis Extension Grapegrowing/Winemaking Courses

UC Davis' Extension offers a variety of courses for novice and experienced grapegrowers and winemakers.

February 9, 9am – 4pm

Managing the Small Vineyard I — The Small Vineyard Series is a quarterly series of one-day classes designed for home and small commercial winegrowers. Instructor: Rhonda J. Smith (UC Extension Sonoma County Farm Advisor). Cost: $175. Enroll in section 123VIT205.

February 13, 9am – 4:30pm

Tasting Room Design and Management — Craig Root (30-year industry veteran and tasting room consultant), will give ideas on how to achieve tasting room perfection. Cost: $195. Enroll in section 123VIT204.

February 21, 9am – 5:30pm

Current Wine and Winegrape Research — Topics: work on grapevine breeding and evaluation, cultural practices, disease and insect pest control, and enology. Instructor: Deborah Golino (FPS). Cost: $49. Enroll in section 123VIT203.

February 21, 8:30 am – 5pm

Health and Safety for Winery Operations Overview — Make your workplace safer by learning best practices and OSHA requirements relevant to winery operations. Instructor: James Persons (Environmental, Health and Safety consultant). Cost: $340. Enroll in section 123HSD516.

February 23 – 24, 8:30 am – 4:30pm

Introduction to Wine Chemistry — For individuals with a winemaking background but no formal training in chemistry, this course provides insights into the interplay of chemical reactions that occur in wine and winemaking. Instructor: Michael Ramsey (UC-D Dept. of Enology & Viticulture). Cost: $280. Enroll in section 123VIT207.

February 23 – 24, 9am – 4pm

Introduction to Sensory Evaluation of Wine — Novice and oenophiles enhance your critical tasting ability, and learn basic aspects of sensory evaluation often overlooked in wine tastings. Instructor: John Buechsenstein. Cost: $550. Enroll in section 123VIT202.

March 23 – 24: 9am – 4pm

Descriptive Analysis of White and Red Table Wines — Intermediate-level course. Instructor: John Buechsenstein. Cost: $550. Enroll in section 123VIT206.

To request more information or to enroll, call 800/752-0881, email extension@ucdavis.edu or visit website: www.extension.ucdavis.edu/winemaking.

SMART VITICULTURE

Continued from page 93

Conclusion

Growth and investment in vineyards and wineries are happening in China, along with national growth in consumption. If and when China's wine production can be sold more profitably overseas, then the world's wine market will feel the impact, as has happened for other items.

The big question is whether China will dominate the world then with wine as it now does for garlic and apples. Global producers for the bulk wine market need to keep a close watch on vineyard development in China, and maybe in the future for premium wines as well.

Dr. Richard Smart is rewriting and thoroughly revising Sunlight into Wine. He is happy to receive statements from growers and winemakers about their commercial success with various aspects of canopy management. Interested persons should contact Dr. Smart by email at richard@smartvit.com.au. Dr. Smart visits the U.S. frequently, and consulting appointments can be made by email. See also www.smartvit.com.au

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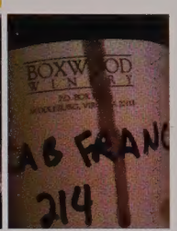

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